Structure and Detailed Syllabus
Undergraduate Course (B.Sc.) in Geology
Learning Outcome based Curriculum
(Under CBCS)
For Affiliated Colleges
Manonmaniam Sundaranar University
Common Course Structure for B.Sc., GEOLOGY – 2024-2025

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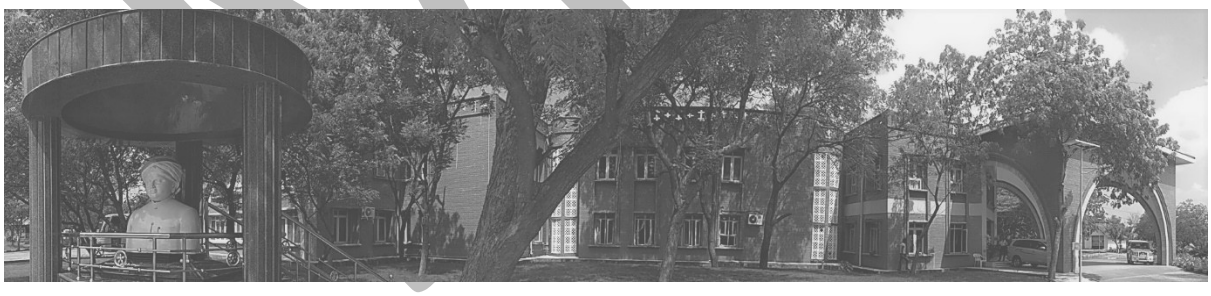

2024-2025

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LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc. GEOLOGY**
Programme Code:	
Duration:	**3 Years (UG)**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan,

	execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team. **PO8: Scientific reasoning:** Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking:** Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning:** Ability to work independently, identify appropriate resources requiredfor a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning:** Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities**: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning**: Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demandsof work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to: **PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory. **PSO2: Critical Thinking:** Analyse complex problems, evaluate information,

	synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively **PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities. **PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models. **PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects. **PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

PO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application-oriented content wherever required.
- The core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The general studies and statistics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the industry-Academia interface and provide more job opportunities for the students.
- The statistical quality control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship/Industrial training/Geological field visit during the fifth semester will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome/ Benefits
I	Foundation Course To ease the transition of learningfrom higher secondary to higher education, providing an over view of the pedagogy of learning. Literature and analyzing the world through the literary lens give rise to an perspective.	➢ Instill confidenceamongstudents ➢ Createinterestforthesubject
I, II, III, IV	Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)	➢ Industry ready graduates ➢ Skilled human resource ➢ Students are equipped with essential skills to make them employable
		➢ Training on language and communication skills enable the student's gain knowledge and exposure in the competitive world.
		➢ Discipline centric skill will improve the technical knowhow of solving real life problems.

III, IV, V & VI	Elective papers	➢ Strengthening the domain knowledge ➢ Introducing the stake holders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and interdisciplinary nature ➢ Emerging topics in higher education/industry/communicationnetwork/healthsectoretc.areintroducedwith hands-on-training.

IV	Elective Papers	➢ Exposure to industry moulds students into solution providers ➢ Generates Industry ready graduates ➢ Employment opportunities enhanced
V	Elective Papers	➢ Self-learning is enhanced ➢ Application of the concept to real situation is conceived resulting in tangible outcome
VI	Elective Papers	➢ Enriches the study beyond the course. ➢ Develop in the research framework and presenting their independent and intellectual ideas effectively.
Extra Credits: **For Advanced Learners/Honors degree**		➢ To cater to the needs of peer learners/research aspirants
Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

CREDIT DISTRIBUTION FOR U.G.

3 – Year UG Programme Credits Distribution			
		No. of Papers	**Credits**
Part I	Tamil (3 Credits)	4	12
Part II	English (3 Credits)	4	12
Part III	Core Courses and Elective Courses	15+12	91
Part IV	Foundation Course	1	2
	Skill Enhancement Courses	5	6
	EVS	1	2
	Value Education	1	2
	Internship/Industrial Visit/ Field Visit	1	2
	Extension Activity	1	1
	Naan Mudhalvan	5	10
Total Credits for the UG Programme			**140**

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

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks (Theory) 50 (Practical)
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks (Theory) 50 (Practical)
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions.	
Understand/Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or Overview.	
Application (K3)	Suggest idea/concept with examples, suggest formulae, Solve problems, Observe, Explain.	
Analyze(K4)	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge.	
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons.	
Create (K6)	Check knowledge in specific or offbeat situations, discussion, debating or Presentations.	

CREDIT DISTRIBUTION FOR B.Sc., GEOLOGY COURSE

2024-2025

SUBJECT		Subject Code	Credits	Hours	Marks		
					CIA	EXT	Total
	I Semester						
1	Tamil		3	6	25	75	100
2	English		3	6	25	75	100
3	Core: General Geology		5	5	25	75	100
4	Core: Practical: General Geology		3	3	50	50	100
5	SEC-1: Field Techniques in Geology		2	2	25	75	100
6	Foundation Course		2	2	25	75	100
7	Allied: Chemistry -I		3	4	25	75	100
8	Allied: Chemistry -I Practical		2	2	50	50	100
	Total		**23**	**30**			
II Semester							
1	Tamil		3	6	25	75	100
2	English		3	4	25	75	100
3	Core: Mineralogy and Crystallography		5	5	25	75	100
4	Core Practical: Mineralogy and Crystallography		3	3	50	50	100
5	SEC-2: Natural Hazards and Mitigation		1	2	25	75	100
6	SEC-3: Remote Sensing and GIS		1	2	25	75	100
7	Allied Chemistry -II		3	4	25	75	100
8	Allied Chemistry -II Practical		2	2	50	50	100
9	Naan Mudhalvan		2	2			
	Total		**23**	**30**			
III Semester							
1	Tamil		3	6	25	75	100
2	English		3	6	25	75	100
3	Core: Palaeontology		4	4	25	75	100
4	Core Practical: Palaeontology		4	2	50	50	100
5	SEC-4: Water quality assessment techniques		1	2	25	75	100
6	Allied Physics-I		3	4	25	75	100
7	Practical: Allied Physics		2	2	50	50	100
8	EVS		2	2	25	75	100
9	Naan Mudhalvan (Mandatory) Fundamentals of Geology (Arrear student)		2	2			
	Total		**24**	**30**			
IV Semester							
1	Tamil		3	6	25	75	100
2	English		3	6	25	75	100

3	Core: Structural Geology		4	4	25	75	100
4	Core Practical– Structural Geology		4	2	50	50	100
5	SEC-5: Elements of Geochemistry		1	2	25	75	100
6	Naan Mudhalvan (Mandatory) Earth and Climate (Arrear student)		2	2			
7	Allied Physics-II		3	4	25	75	100
8	Practical: Allied Physics		2	2	50	50	100
9	Value Education		2	2	25	75	100
	Total		**24**	**30**			
V Semester							
1	Core: Igneous Petrology		4	5	25	75	100
2	Core: Sedimentary and Metamorphic Petrology		4	5	25	75	100
3	Core: Hydrogeology		4	5	25	75	100
4	Core Practical: Petrology and Hydrogeology		3	5	50	50	100
5	Elective: Stratigraphy or Environmental Geology		3	4	25	75	100
6	Elective: Marine Geology or Engineering Geology		3	4	25	75	100
7	Naan Mudhalvan (Mandatory) Geomorphology (Arrear student)		2	2			
8	Internship / Industrial Training / Geological Field studies. (Report evaluation and viva-voce by External examiners)		2	-	50	50	100
	Total		**25**	**30**			
VI Semester							
1	Core: Economic Geology and Mineral Economics		4	6	25	75	100
2	Core: Applied Geology		4	6	25	75	100
3	Core Practical: Economic Geology and Mineral Economics & Applied Geology		4	6	50	50	100
4	Elective: Regional Geology or Geostatistics and Computer Applications in Geology		3	5	25	75	100
5	Elective: Geophysics and Exploration Techniques or Disaster management		3	5	25	75	100
6	Extension Activity- Long Geological field studies (Maximum 14 Days) (Report evaluation and viva-voce by External examiners)		1	-	50	50	100
7	Naan Mudhalvan (Mandatory) Geohazards (Arrear student)		2	2			
	Total		**21**	**30**			
		Total	**140**				

B.SC. GEOLOGICAL FIELD WORK
(Mandatory requirements for the completion of B.Sc. Geology programme)

It is an integral part of the course; students should be taken to a field training during the academic year.

FIRST YEAR

Students should be taken to the Physical geology or minerals aspects or decision by the Professor in-charge of geological study visit. The duration of the trip maximum 2 days either first or second semester and submit a report at the time of 5th semester practical examination. Report evaluation and viva-voce conducted by Internal and External examiners **(2 Credits; Internal 50 and External 50 Marks)**.

SECOND YEAR

1. Students should be taken to nearby area and familiarize palaeontological and or structural aspect or decision by the Professor in-charge, collect geological samples from the field and display at the time of 5th semester practical examination. Report evaluation and viva-voce conducted by Internal and External examiners. The duration of the trip maximum 2 days either third or fourth semester.

2. Students should be taken to geological mapping camp, the area chosen by the Professor in-charge and the duration of the camp maximum 7 days either third or fourth semester and submit a report at the time of 5th semester practical examination. Report evaluation and viva-voce conducted by Internal and External examiners **(2 Credits; Internal 50 and External 50 Marks)**.

THIRD YEAR

1. Students should be taken to the coastal geomorphological aspects/decision by the Professor in-charge of geological study visit. The duration of the trip maximum 2 days in fifth semester and submit a report at the time of 5th semester practical examination. Report evaluation and viva-voce conducted by Internal and External examiners **(2 Credits; Internal 50 and External 50 Marks)**.

2. A visit to geologically interested and mineralized zones in South India, it includes mines visit, fossils, minerals, rocks and economic minerals collection and display at the time of their 6th semester practical examination for internal and external evaluation. The duration may be for two weeks in 6th semester **(1 Credits; Internal 50 and External 50 Marks).**

First year: Semester-I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	General Geology	Core	Y	-	-	-	5	5	25	75	100

Course Objectives	
CO1	The main objective of this course is to enumerate the origin of Earth, its interior and its age.
CO2	To describe the concepts of rock weathering and wind
CO3	To explain Geological agent: Glacier and sea
CO4	To explain Geological agents: River and Groundwater
CO5	To describe all the dynamic activities of Earth

Unit	Details	No. of Hours	Course Objectives
I	A brief account of various theories regarding the origin of earth. Interior of the Earth: an outline of the composition and constitution of the interior of earth. Age of the earth: relative dating and absolute dating – radiometric dating: Potassium – Argon, Rubidium – Strontium, Uranium – Lead, Lead –Lead, Fission track dating and Carbon dating method.	15	CO1
II	Rock weathering: Geology and weathering-agents of weathering, processes of weathering-mechanical weathering: Frost wedging, frost heaving, saltaction and sheeting, chemical weathering: solution, hydration, hydrolysis, oxidation/reduction, carbonation and chelation. Biotic weathering: biophysical and biochemical. Mix processes: spheroidal, exfoliation and differential weathering. Soil–definition, types and formation process of soils- Soil Horizon Wind as a Geological Agent: erosional methods: deflation, corrosion and its impact. Erosional features-By abrasion: undercut hills, cave rock, mushroom rock, mesa, yardang, ventifacts. By Deflation: desert pavement, deflation hallows. Transportation-saltation, suspension and traction. Deposition-causes and types, pile and sheets deposits-dune formation, migration and different forms. Desert: description, kinds and desert features: plains, bajadas and pediment.	15	CO2
III	Work of Glaciers: Types of glaciers: cirque, valley, piedmonts and continental glaciers- Glacial movement-erosional processes-erosional features-	15	CO3

	depositional features. Work of sea and its deposits: waves, breakers, rip-current, long-shore current. Processes of erosion, erosional features: wave cut terraces, sea cave and arch, headland, stacks, transportation and various depositional features: beaches and barriers, spits and bars, deltas, wave-built terraces. Ocean deposits: shallow water and deep-water deposits.		
IV	Development of drainage system and work of stream: channel characteristics- stream erosion characteristics, types of streams, drainage patterns, Erosional features-valleys, river piracy, waterfalls, cascade, water gaps, pot holes and plunge pools, river terraces, meanders, ox-bow lakes, pediments and peneplains, transportation methods, causes of stream deposition, depositional features-deltas, point bars, natural levees, alluvial fans, floodplain, back swamps, and braided rivers. Types of streams and drainage patterns. Work of Ground water: movement of ground water due to gravity and pressure difference- ground water discharge-springs, wells and artesian wells and springs, thermal springs. Erosion by ground water and erosional features. Transportation by ground water, deposition by ground water and forms of deposits.	15	CO4
V	Plate tectonics: Historical background –Characteristics of plates – Major plates – plate movements – Plate boundaries: divergent: mid-oceanic ridges, continental rift, triple junction, geological characters; convergent: ocean – ocean, ocean – continent, continent – continent convergence, geological characters and transform fault boundary - causes for the plate movement. Volcanoes: classification: based on state of the volcano, structure of volcano, kind of material erupted, eruptive force and location of volcano. Products of volcano: Gases, liquids, and solids. Earthquake- Definition - causes- classification-seismic waves: Body waves and surface waves-earthquake detection and measurement–determination of epicenter – scale of earthquake: intensity and magnitude scale- effects of earthquakes– Tsunami-causes and effects.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the origin of galaxy and solar system, interior of the earth and age of the earth	PO1
CO2	Rock weathering and wind as a geological agent	PO1, PO2
CO3	Geological Agents: Glaciers and Sea	PO3, PO6
CO4	Geological Agents: River and Groundwater	PO4, PO5, PO6
CO5	Various dynamic activities of Earth	PO3, PO8
Text Books (Latest Editions)		
1.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)	
2.	Arthur Holmes, Principles of Physical Geology: Thomas Nelson & sons London. (1992)	
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)	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Charles C. Plummer, Diane H. Carlson and Lisa Hammersley (2019). 'Physical Geology' (16th Ed). McGraw-Hill Education.	
2.	Strahler A. M (1965). Introduction to Physical Geology. Wiley.	
3.	Gass, I.G., Smith, P.S & Wilson, R.C.L., 2ndEdt., (1972), Understanding the Earth, The English Language Books Society, London	
4.	Robert, S.A. and Suzanne, P.A., (2010) Geomorphology – The mechanics and chemistry of landscapes. Cambridge University Press.	
5.	Mahapatra, G. B. (2018). Textbook of Physical Geology. India: CBS Publishers & Distributors.	
Web Resources		
1.	https://opentextbc.ca/geology/	
2.	https://serc.carleton.edu/geo2yc/courses/46478.html	
3.	Geo.libretexts.org	
4.	www.nationalgeographic.org	
5.	Solarsysytem.nasa.gov	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	General Geology Practical	Core	Y	-	-	-	3	3	50	50	100

Course Objectives	
CO1	To understand various laws of Geology through activity.
CO2	To know the changes happen on the earth through time
CO3	To realize the application of Density and gravity concept in Geology
CO4	To know the velocity, distance and time of changes on earth
CO5	To understand the concepts of topographic map

Unit	Details	No. of Hours	Course Objectives
I	Identifying the geological events of an area using geological laws: Conformity, Unconformity, Law of superposition, Law of cross-cutting.	09	CO1
II	Calculating changes through time : in Plate tectonics, Stream and Groundwater, Glaciers, mountain building and erosion.	09	CO2
III	Density and Specific Gravity in the Geosciences: in Isostasy, Plate tectonics, Minerals and Rocks.	09	CO3
IV	Velocity, Distance and Time: in Geophysics, Groundwater studies, Climate change, Plate tectonics. Density in rocks and Minerals.	09	CO4
V	Relief and Gradient Analysis from topographic maps. Construction of topographic profiles from a topographic map.	09	CO5
	Total	**45**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	To understand various laws of Geology through activity.	PO1
CO2	To know the changes happen on the earth through time	PO1, PO2
CO3	To realize the application of Density and gravity concept in Geology	PO3, PO6
CO4	To know the velocity, distance and time of changes on earth	PO4, PO5, PO6
CO5	To understand the concepts of topographic map	PO3, PO8

Text Books (Latest Editions)	
1.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)
2.	Arthur Holmes, Principles of Physical Geology: Thomas Nelson & sons London. (1992)
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4.	www.nationalgeographic.org
5.	Solarsysytem.nasa.gov

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The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Field Techniques in Geology	SEC-1	Y	-	-	-	2	2	25	75	100

Course Objectives	
CO1	The main objective of this course is to understand the importance of field studies.
CO2	To study the various field measurements using basic equipment.
CO3	To understand the various changes in the earth surface.
CO4	To study concepts of various sample types and sampling techniques.
CO5	To understand the field data representation and fled report preparation methos.

Unit	Details	No. of Hours	Course Objectives
I	Importance of Field study in Geology – Geological Mapping: Definition, types of maps (Topography, Cadastral, and Revenue), scale of the map, representative fraction, legends (geographical and geological), mapping techniques (Toposheet, satellite imagery, base map preparation)	06	CO1
II	Field instruments: The Brunton compass, components of compass, taking bearing using compass and its uses. The Clinometer, components of clinometer, taking measurement using clinometer. Basic field equipment (geological hammer, pocket knife, hand lens, notebook, pen, marker, and sample bags)	06	CO2
III	Geological sampling (minerals, rock, fossils, and waters samples): Aims and objectives of the field work, selecting the field area, types of sampling (Surface sampling. Channel/ Grooves sampling, Chip sampling, Grab sampling/Muck sampling, Wagon sampling, Bulk sampling, Core sampling, Sludge sampling), preparing sketches and taking photographs, recording the observations	06	CO3
IV	Study of outcrops to distinguish between loose boulders and in-situ outcrops, importance of rock contacts, mapping by following rock contacts. Observations of contacts concealed under soil or vegetation (open wells, road cuttings, open quarry, open mines), determination of dip and strike of strata, field correlation.	06	CO4
V	Preparation of a geological report: i) Compilation of field data, ii) Preparation of a report (quotations and footnotes, illustrations, table of contents and index).	06	CO5
	Total	**30**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.

Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	The main objective of this course is to understand the importance of field studies	PO1
CO2	To study the various field measurements using basic equipment	PO1, PO2
CO3	To understand the various changes in the earth surface	PO4, PO6
CO4	To study concepts of various sample types and sampling techniques.	PO4, PO5, PO6
CO5	To understand the field data representation and fled report preparation methos.	PO3, PO8

Text Books
(Latest Editions)

1.	Robert R. Compton, (1962). Manual of Field Geology.John Wiley & Sons, Inc., London
2.	Frederick H. Lahee, (1917). Field Geology. New York: McGraw-Hill; London: Hill
3.	Mukherjee A. K, (1990). Principles of Geology. E W Press, Kolkata
4.	Marland, P. Billings, (2016), Structural Geology 3rd Edition, Pearson Education
5.	Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York (2005)

References Books
(Latest editions, and the style as given below must be strictly adhered to)

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.	Gokhale N.W (2009). A Guide to Field Geology. CBS Publishers & Distributors, New Delhi
4.	DeSitter, L. U. (1956). Structural geology, Mc Graw Hill, New York
5.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)

Web Resources

1.	" https://www.geolsoc.org.uk/FieldResources.
2.	https://serc.carleton.edu/NAGTWorkshops/structure/resources.html
3.	Geo.libretexts.org
4.	https://uh.edu/~jbutler/anon/anoncoursestructure.html
5.	https://geopad.ucr.edu/resources

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Foundation Course		Y	-	-	-	2	2	25	75	100

Course Objectives	
CO1	To understand elements of physics related to geology.
CO2	To understand the elements of solar system and various spheres of earth.
CO3	To describe the concepts of chemistry to understand geological processes.
CO4	To study the concepts of place, time, calendar and seasons.
CO5	To know the concept of geological time scale.

Unit	Details	No. of Hours	Course Objectives
I	Definition of Geology, various branches of Geology, Development of Geology. Place and Time: Latitude and longitude, determination of latitude and longitude. Concept of time and magnitude of geological time. The seasons and calendar, precession of the earth's axis.	06	CO1
II	The solar system and planetary motion, major planet classifications and orbits. Earth as a system: Geosphere, Hydrosphere, Biosphere, Atmosphere and its interactions between them.	06	CO2
III	Atmospheric circulation -Weather and climatic changes, Earth's heat budget, Oceanic current system, and effect of Coriolis force. Concepts of eustasy, Earth-Atmosphere-Ocean interaction, Wave erosion and beach processes.	06	CO3
IV	Components of Hydrologic cycle, rock cycles and its process. Climate changes – Natural causes.	06	CO4
V	Geological time scale, Fossils, types of fossils, basic concepts of relative and radiometric dating.	06	CO5
	Total	**30**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference. Each course outcome should be mapped with the POs. The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the properties of Earth	PO1
CO2	To understand the elements of solar system and various spheres of earth.	PO1, PO2
CO3	To describe the concepts of chemistry to understand geological processes.	PO4, PO6
CO4	To study the concepts of place, time, calendar and	PO4, PO5, PO6

	seasons.	
CO5	To know the concept of geological time scale.	PO3, PO8
Text Books (Latest Edition)		
1.	Shipman. J. T, Wilson J.D, Higgins C.A and Lou Bo (2021). An Introduction to Physical Science. Cengage	
2.	Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press.	
3.	Jerry Wilson, James Shipman and Charles Higgins (2015). An Introduction to Physical Science. Brooks/Cole, 14th Edition.	
4.	Todd, D.K. (2008). Groundwater Hydrology.5thed. Wiley. New Delhi.	
5.	Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York (2005)	
References Books (Latest edition, and the style as given below must be strictly adhered to)		
1.	Haydn A. "Chip" Fox (2021) Science in our Lives an Introduction to Physical Science.	
2.	James T. Shipman, Jerry D. Wilson, Charles A. Higgins and Omar Toores (2015) An Introduction to Physical Science. Books Cole Cengage learning.	
3.	National Geographic (2008) Introduction to Physical Science. McGrew-Hill Company.	
4.	Richard E. Chapman (2002) Physics for Geologists. CRC Press.	
5.	Radhakrishnan, V, (1996) General Geology, V.V.P. Publishers, Tuticorin.	
Web Resources		
1.	https://opengeology.org/textbook/	
2.	https://egcc.libguides.com/geology/websites.	
3.	Geo.libretexts.org	
4.	www.nationalgeographic.org	
5.	Solarsysytem.nasa.gov	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER - II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Mineralogy and Crystallography	Core	Y	-	-	-	5	5	25	75	100

Course Objectives	
CO1	Remember the basic various physical properties, optical properties
CO2	To describe the concepts of basic statistics
CO3	To understand the physical, optical and other properties to determine the different groups and crystal systems.
CO4	To understand the crystal parameters in minerals and crystal models
CO5	To understand the industrial applications and economic importance of various minerals.

Unit	Details	No. of Hours	Course Objectives
I	Mineralogy: Definition, Characters and Uses -Physical Properties of Minerals: Colour, streak, lustre, hardness, habit, cleavage, fracture, Odour, fluorescence and Phosphorescence, feel, tenacity, specific gravity, magnetism. Chemistry of minerals: general principals of chemical properties of minerals: atom, ions, molecules, atomic number, mass number, valence, ionic radii–bonding in minerals–atomic substitution and solid solution-Isomorphism, polymorphism and pseudomorphism. Classification of minerals: Classification schemes, Chemical Classification of Minerals, Structural classification of silicates.	15	CO1
II	Rock Forming Minerals Group: Physical properties, chemical composition, classification, diagnostic properties and mode of occurrence of the following groups: Quartz, Feldspar, Feldspathoid, Amphibole, Pyroxene, Olivine, Mica and Garnet.	15	CO2
III	Optical Mineralogy: Properties of Light: Nature of light-ordinary and plane polarised light- Light interaction with matter; reflection, defuse reflection, refraction, double refraction, refractive Index, total reflection, dispersion, relative retardation and birefringence. Polarising Microscope: Parts of polarising microscope and its uses - Study of optical properties of minerals: Optical properties under plane Polarised Light: Form, Colour, relief, Refractive Index, Cleavage, Inclusion and Alteration, Pleochroism, Twinkling. Optical properties between cross nicol: Isotropism/Anisotropism, Interference	15	CO3

	colors, Extinction, Twinning, Zoning**.** Construction of Nicol prism-Preparation of Thin Section.		
IV	Definition for crystal – Morphological characters of crystals – Faces – Forms – Edge, Solid angle – Interfacial angle – Uses of Contact Goniometer. Law of constancy of the Interfacial angles, Symmetry elements, crystallographic axes – Miller indices – Law of rational indices. Definition of Holohedral, Hemimorphic, Enantiomorphic and Hemihedral.	15	CO4
V	Crystal Systems: Classification of crystal systems-Classification of crystals into seven systems. Morphological study of seven crystallographic systems with special reference to the elements of symmetry of their normal class. Cubic system–Normal (Galena type)-Tetragonal system – Zircon type - Hexagonal system – Beryl type - Trigonal system- Calcite type - Orthorhombic system – Barytes type - Monoclinic system – Gypsum type –Triclinic system– Axinite type. Twinning in crystals and its types.	15	CO5
	Total	**75**	

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The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the physical and optical properties of minerals.	PO1
CO2	Helps to classify the minerals into different groups.	PO1, PO2
CO3	Able to identify different minerals using physical and optical properties.	PO4, PO6
CO4	Understand the symmetry elements and symmetry element of crystals.	PO4, PO5, PO6
CO5	Apply the understanding of physical, optical and other properties to determine the different groups and crystal systems.	PO3, PO8

Text Books

1.	Read, H.H. (1916). Routley's elements of Mineralogy, Thomas Murphy & co,. London.
2.	Ford, W.E. (1988). Dana's Text book of Mineralogy. Wiley. New Delhi. (Reprint).
3.	Deer, Howie and Zussman (1964). An introduction to rock-forming minerals. Orient Longman, London.
4.	Naidu, P.R.J. (1967). Optical Mineralogy.

5.	Introduction to Mineralogy by William D. Nesse, Edition: 2nd, Oxford University Press, 2012
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Kerr, Paul. (1977). Optical mineralogy, McGraw hill, New York.
2.	Mineralogy by Perkins, 3rd Ed, Pearson Education, India, 2015
3.	Manual of Mineralogy" by Klein C and Hurlbut C S, John Wiley and Sons Ltd, 1985
4.	Advanced Characterization of Industrial Minerals by G. Christdis, Mineralogical Society of Great Britain & Ireland. 2011
5.	Basics of Crystallography, Mineralogy and Geochemistry: A concise Text book by B.S.Rathore, Notion Press, 2021
Web Resources	
1.	https://opengeology.org/Mineralogy/
2.	https://serc.carleton.edu/NAGTWorkshops/mineralogy/index.html
3.	https://nu.kz.libguides.com/crystallography_guide/resources
4.	https://www.freebookcentre.net/EarthSciences/Mineralogy-Books.html
5.	http://www.minsocam.org/msa/dgttxt/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Mineralogy and Crystallography Practical	Core	Y	-	-	-	3	3	50	50	100

Course Objectives	
CO1	Apply the basic physical properties of minerals in its identification.
CO2	To evaluate the minerals based on megascopic identification.
CO3	To understand the mineral character under light.
CO4	To study various class and forms of crystal systems.
CO5	To determine various crystallographic properties of crystals with suitable examples.

Unit	Details	No. of Hours	Course Objectives
I	Megascopic Identification and description of the following silicate mineral groups. Quartz and its varieties, Feldspar group, Feldspathoids.	09	CO1
II	Megascopic identification and description of the following: Pyroxene group, Amphibole group, Epidote group, Mica group, Garnet group and Alumino Silicates.	09	CO2
III	Microscopic identification and Description of the following: Quartz, Orthoclase, Microcline, Albite, Oligoclase, Labradorite, Nepheline, Leucite, Enstatite, Hypersthene, Glaucophane, Biotite, Muscovite, Olivine, Epidote, Garnet, Apatite, Zircon, Sphene, Tourmaline, Calcite, Andalusite, Kyanite, Sillimanite, Staurolite, and Cordierite.	09	CO3
IV	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 Sphenidal Class – Chalcopyrite. Hexagonal System: Normal Class – Beryl, Tripyramidal – Apatite, Hemimorphic – Zincite, Rhombohedral Normal – Calcite, Trapezohedral Class – Quartz.	09	CO4
V	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.	09	CO5

	Total	**45**	

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Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
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.	PO1
CO2	To describe the concepts of Mineralogy is essential to comprehend the concepts of Petrology.	PO1, PO2
CO3	To explain the importance of instrumentation techniques for better analysis	PO4, PO6
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	PO4, PO5, PO6
CO5	Can evaluate the accuracy and summaries the methods adapted for certain practical activities.	PO3, PO8

Text Books
(Latest Editions)

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).

References Books
(Latest editions, and the style as given below must be strictly adhered to)

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.	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

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Natural Hazards and Mitigation	SEC	Y	-	-	-	2	2	25	75	100

Course Objectives	
CO1	Remember the concepts of hazards
CO2	Understand the causes and consequences of earthquake
CO3	Apply the knowledge for prevention techniques for natural hazards.
CO4	Analyze the various natural hazards and its impact and preparation of hazards map
CO5	Evaluate the risk reduction techniques and methods

Unit	Details	No. of Hours	Course Objectives
I	Introduction to natural hazards and disasters, historical background -The lithosphere and related hazards Atmospheric hazards, Hydrosphere and Related hazards, Human impact on natural disaster, Mitigating hazards, Plate tectonics and related hazards	06	CO1
II	Climatical hazards – climate change – atmospheric circulation – Definition, types, causes, effects and preventing techniques of large scale and small scale storm hazards – drought hazards – flooding hazards. Fire related hazards	06	CO2
III	Definition, types, causes, effects and prevention techniques of earthquake hazard, landslide hazards, volcanic eruptions and tsunami. Health and population related hazards.	06	CO3
IV	Marine Hazards: Marine pollution, ocean wave hazards, sea ice hazards, sea level rise hazards, ocean morphological changes, beach erosion hazards, marine transport hazards, marine exploration hazards, and prevention techniques for marine hazards.	06	CO4
V	Disaster management in India risk, Vulnerability and hazard mitigation through capacity building legislative responsibilities of disaster management; disaster mapping, assessment pre-disaster risk & vulnerability reduction, post disaster recovery, rehabilitation disaster related infrastructure development. Remote-sensing and GIS applications in hazards monitoring.	06	CO5
	Total	**30**	

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The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Remember the concepts of hazards	PO1
CO2	Understand the causes and consequences of earthquake	PO1, PO2
CO3	Apply the knowledge for prevention techniques for natural hazards.	PO4, PO6
CO4	Analyze the various natural hazards and its impact and preparation of hazards map	PO4, PO5, PO6
CO5	Evaluate the risk reduction techniques and methods	PO3, PO8
Text Books (Latest Editions)		
1.	Monroe, J. S., Wicander, R., and Hazlett, R. (2007). Physical Geology: Exploring the Earth. Sixth Edition.	
2.	Strahler, A. Introduction to Physical Geology. Pub. John Wiley & Sons, Inc. page 632.	
3.	Hyndman, D., and Hyndman, D. (2011). Natural Hazards and Disasters. Third Edition. Pages 571.	
4.	Keller, E. D. (2012). Introduction to Environmental Geology. Printice Hall. Page 801.	
5.	Holmes, A & P. L. Duff. (1996). Principles of Physical Geology, 4th revised Edition, ELBS, London	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Radhakrishnan, V. (1996). General Geology, V.V.P. Publishers, Tuticorin.	
2.	Mahapatra, G. P. (1994). Physical Geology, CBS Publishers, New Delhi.	
3.	Porter, S. C & B. J. Skinner. J. (1995). The Dynamic Earth, John Wiley & Sons, New York.	
4.	Leet, D & Judson, S (1987). Physical Geology, McGraw Hill. New Jersey.	
5.	Patwardhan, A. M. (1999). Dynamic Earth System, Prentice Hall, New Delhi	
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.	Solarsysytem.nasa.gov	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Remote Sensing and GIS	SEC	Y	-	-	-	2	2	25	75	100

Course Objectives	
CO1	Remember the Indian satellite types
CO2	Understand the various photo recognition elements from remotely sensed data
CO3	Apply the concepts of platforms and satellite orbits
CO4	Analyze the remote sensing principles and photo recognition elements to identify various features
CO5	Evaluate the GIS components and vector and raster data

Unit	Details	No. of Hours	Course Objectives
I	Remote sensing: Definition, Basic concepts and principles of remote sensing, advantages and limitations - components of remote sensing - Electromagnetic Radiation: Properties of EMR, Electromagnetic Spectrum – Atmosphere Interaction: Refraction, Scattering, and Absorption. Electromagnetic energy-Earth Interaction: Reflection, Transmission – Spectral signature: Spectral signature of vegetation, spectral signature of soil, Spectral signature of water, Spectral signature of minerals and rocks.	06	CO1
II	Remote Sensing Platforms: Terrestrial Platforms, Airborne Platforms, Space borne Platforms- Types of Satellites: Astronomical Satellites, Communication Satellites, Weather Satellites, Earth Observation Satellites, Navigation Satellites, Reconnaissance Satellites - Orbits and their Types: Geosynchronous Orbit, Sun synchronous Orbit- Sensor System: Multi spectral Imaging Sensor System, Thermal Remote Sensing System, Microwave Imaging System -Image Resolution-Types of Image Resolutions: Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution.	06	CO2
III	Aerial photographs – scales and types of aerial photographs - photo interpretation techniques – applications of aerial photographs. Mosaics: controlled and uncontrolled mosaics – advantage and disadvantages – application of mosaics in geology studies. Types of data products – types of image interpretation – basic elements of image interpretation – visual interpretation keys.	06	CO3
IV	GIS definition - history of GIS – Components of GIS – Hardware, Software, Data, People and Procedure. – GIS sub systems - Data types: Spatial data: raster, vector, TIN	06	CO4

	– Nonspatial data. Coordinate systems: Geographic coordinate system, datum and map projection and its types, projected coordinate systems.		
V	Vector Data Model: Spaghetti Vector Model, Topological Vector Models. Raster data models: Simple Raster Arrays, Hierarchical Raster Structures, Types of Raster GIS Models, Compact Raster Data Models. Attribute data model: Hiearchial, network, relational and object-oriented model. Data Base Management System: functions of DBMS, components of DBMS, data file management: simple list, ordered sequential files, indexed files.	06	CO5
	Total	**30**	

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The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the Indian satellite types	PO1
CO2	Understand the various photo recognition elements from remotely sensed data	PO1, PO2
CO3	Apply the concepts of platforms and satellite orbits	PO4, PO6
CO4	Analyze the remote sensing principles and photo recognition elements to identify various features	PO4, PO5, PO6
CO5	Evaluate the GIS components and vector and raster data	PO3, PO8

Text Books
(Latest Editions)

1.	Curran, P. B. (1985). Principles of Remote Sensing. ELBS. London.
2.	Lillisand, T. M & R. W. Kiefer. (2000). Remote Sensing and Image Interpretation. Wiley, Delhi.
3.	Drury, S. D. (1993). Image Interpretation in Geology. Allen & Unwin. London.
4.	Reddy, A. (2010). Principles of Remote Sensing and GIS. CBS. Delhi.
5.	Miller, V. C. (1961). Photogeology. McGraw Hill. New York.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Pandey, S. N. (1989). Principles and Applications of Photogeology. Wiley Eastern. New Delhi.
2.	Gupta, R. P. (1990). Remote Sensing Geology, Springer Verlag.
3.	Benhardsen, T., (2002). Geographic Information Systems: an Introduction, John Wiley & Sons, New York.
4.	Guha, P.K., (2008). Remote Sensing for the Beginner, Second Edition, East-West press pvt.ltd, New Delhi.178 pp.
5.	Ian Heywood, Sarah Corrdius and Stevecarver, 2000. An introduction to

	Geographic Information system. Longman Ltd, New York.
Web Resources	
1.	A Canada Centre for Remote Sensing Remote Sensing Tutorial
2.	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutor/ fundam/pdf/fundamentals_e.pdf
3.	https://open.umn.edu/opentextbooks/textbooks/67
4.	Jonathan Campbell and Michael Shin (2011) Essentials of Geographic Information Systems

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Semester-III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Palaeontology	Core	Y	-	-	-	4	4	25	75	100
Course Objectives											
CO1	Understand the basics of fossils										
CO2	Understand the importance of fossils in Geological studies										
CO3	Understand about different phylum and species with morphological characters										
CO4	Understand and correlate fossils with various rock formations										
CO5	Understand the importance of Palaeontology in dating and evolution studies										
Unit	**Details**							**No. of Hours**		**Course Objectives**	
I	Fossils: Definition, conditions required for fossilization, Modes of preservation, Uses of fossils. Geological time scale.							12		CO1	
II	The morphology and geological distribution of Mollusca-classes, Pelecypoda, Gastropoda, Cephalopoda – orders, Nautiloidea, Ammonoidea, Dibranchia and Belemnites.							12		CO2	
III	Phylum: Brachiopoda, Coelenterata. Class: Anthozoa, Sub class: Zoantharia, Orders: Rugosa, Tabulata and Scaleractina. Phylum – Hemichordata – Class Graptozoa, Order Dendroidea, Order Graptolitoidea.							12		CO3	
IV	Phylum – Arthropoda Class – Trilobita Phylum – Echinodermata Class - Echinoidea Class – Crinoidea. Class: Blastoidea. Introduction to Paleobotany, Gondwana Flora.							12		CO4	
V	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.							12		CO5	
	Total							**60**			

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basics of fossils	PO1
CO2	Understand the importance of fossils in Geological studies	PO1, PO2
CO3	Understand about different phylum and species with morphological characters	PO4, PO6
CO4	Understand and correlate fossils with various rock formations	PO4, PO5, PO6
CO5	Understand the importance of Palaeontology in dating and evolution studies	PO3, PO8

Text Books
(Latest Editions)

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).

References Books
(Latest editions, and the style as given below must be strictly adhered to)

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

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Palaeontology Practical	Core	Y	-	-	-	4	2	50	50	100

Course Objectives	
CO1	To evaluate morphological characters of some important invertebrate fossils

Unit	Details	No. of Hours	Course Objectives
I	Study of the morphological characters of some important invertebrate fossils belonging to Brachiopoda, Pelecypoda, Gastropoda, Ceppalopods, Trilobita, Echinoidea, Corals and Plantfossils.	6	CO1
II	Determination of valves and dental formula of Pelecypoda	6	CO2
III	Evolutionary study of Trilobites and Ammonites.	6	CO3
IV	Identifying invertebrate fossils, drawing neat sketches and labelling its parts.	6	CO4
V	Study of the morphological characters of some important plant fossils	6	CO5
	Total	**30**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the Process of Endogenic/Exogenic	PO1
CO2	Understand the valves and dental changes.	PO1, PO2
CO3	Apply the knowledge on the age determination using fossils	PO4, PO6
CO4	Analyze evolutionary history of the land forms with the help of fossils.	PO4, PO5, PO6
CO5	Evaluate morphological characters of some important invertebrate fossils	PO3, PO8

Text Books
(Latest Editions)

1.	Ramachandra Rao, M. B., Prasaranga, 1975. Outlines of Geophysical Prospecting–A manual for geologists by University of Mysore, Mysore.
2.	Bhimasarikaram V. L. S. 1990. Exploration Geophysics- An Outline by., Association of Exploration Geophysicists, Osmania University, Hyderabad.
3.	Dobrin, 1984. An Introduction to Geophysical Prospecting by, M. B. McGraw Hill, New Delhi.
4.	Telford W. M. Geldart L. P., Sheriff, R. E. and Keys D. A. 1976, Applied Geophysics. Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi,
5.	Parasnis, D. S 1975. Principles of applied Geophysics, Chapman and Hall.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Kearey, P Brooks (1991) An introduction to geophysical exploration, Blackwell
2.	Umeshwar Prasad, 1996, Economic geology, CBS Publishers and distributors, NewDelhi.
3.	Todd, D. K. (2008). Groundwater Hydrology. 5th ed. Wiley. New Delhi.
4.	Davis, S. N. & R. J. M. DeWiest (1966). Hydrogeology.Wiley.Delhi.
5.	Edward R. and Atkinsan K. 1986. Ore deposit Geology, Chapmon and Hall,
Web Resources	
1.	https://geologyscience.com/geology-branches/geophysical-methods/
2.	https://www.gsi.ie/en-ie/programmes-and-projects/minerals/activities/mineral-exploration/Pages/Geophysical-Methods.aspx
3.	https://www.science.gov/topicpages/g/geophysical+exploration+techniques
4.	https://www.ngri.res.in/#
5.	https://clu-in.org/characterization/technologies/default2.focus/sec/Geophysical_Methods/cat/Overview/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	WATER QUALITY ASSESSMENT TECHNIQUES	SEC	Y	-	-	-	1	2	25	75	100

Course Objectives	
CO1	Remember the Water Quality and assessment
CO2	Understand the various water quality parameters
CO3	Apply the concepts of methods of analysis in water quality indices
CO4	Analyze the water quality index in drinking and agriculture purposes
CO5	Evaluate the water treatment in various chemical and biological parameters

Unit	Details	No. of Hours	Course Objectives
I	Sources of Water- Meaning of Pure and Impurities in water. Water Quality: Terminology, Sources of water pollutants, pollution kinetics and reaction mechanism. Water Quality Standards: International (WHO) and Indian Standards (BIS) for drinking, irrigation, industrial and aquatic use. QA/QC in Water Quality Monitoring and Analysis.	06	CO1
II	Water Quality Parameters: Physical parameters, Chemical parameters, Bacteriological parameters. Physical Properties of Water: pH, Color, Odor, Taste, Temperature, Turbidity, Viscosity, Dissolved Residue and Suspended Residue.	06	CO2
III	Methods of Analysis in Chemical Properties of Water: Standard Solutions – Hardness, DO, BOD, COD, TDS, TSS. Major Cations- Na, K, Ca, Mg. Major Anions- HCO_3, $CaCO_3$, Cl, SO_4, NO_3, PO_4, F. Trace metals samples preparation and Instrumentation.	06	CO3
IV	Methods of Analysis in Bacteriological Properties of Water: MPN Test- Faecal Coliform Count, Total Coliform Count, E. Coli, Faecal Streptococci. Water Quality Index: Principle, International and Indian standards, parameters considered for surface and ground water indexing.	06	CO4
V	Water Treatment Methods: Aeration, nitrogen removal, arsenic and fluoride removal, pH control, removal of solids and gases in water, disinfection, and ion-exchange. Use of chlorine, bromine, iodine, $KMnO_4$ etc. for disinfection. Water Treatment Plant: Components and	06	CO5

	Working Principles. Waste Water Treatment: Methods and Instruments.		
	Total	**30**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the Water Quality and assessment	PO1
CO2	Understand the various water quality parameters	PO1, PO2
CO3	Apply the concepts of methods of analysis in water quality indices	PO4, PO6
CO4	Analyze the water quality index in drinking and agriculture purposes	PO4, PO5, PO6
CO5	Evaluate the water treatment in various chemical and biological parameters	PO3, PO8

Text Books
(Latest Editions)

1.	Kodarkar, M. S. (2000). Methodology of water analysis. IAAB Publication. Hyderabad.
2.	Rangwala, R.C (2000). Water and Waste water Engineering. Wiley, Delhi.
3.	Silva E.I.L. Namaratne S.Y. Weerasooriya S.V.R. Manuweera L. (1996). Water Analysis. Srilanka.
4.	Chapman, D., Ed., (1992) Water Quality Assessments - A Guide to the use of biota, sediments and water in environmental monitoring, Chapman and Hall Ltd., London.
5.	Fresenius, W., Quentin, K.E., and Schneider, W., Eds., (1988) Water Analysis, Springer-Verlag Berlin Heidelberg. Germany.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Selvam, S., Venkatramanan, S., Prasanna M.V., and Chidambaram, S., (2023) Groundwater Contamination in Coastal Aquifers: Assessment and Management. Elsevier Science Publishing Co Inc
2.	Khopkar S. M. (2010) Basic concepts of analytical chemistry. Delhi.
3.	Kemp, P.F., Sherr, B.F., Sherr, E.B.. and Cole, J.J.. Eds., (2003) Handbook in methods in Aquatic Microbial Ecology, Lewis Publishers, USA.
4.	Skoog, D. A., (1985) Principles of Instrumental Analysis, 3rd Ed., Saunders College Publishing, USA.

Web Resources

1.	https://fssai.gov.in/upload/uploadfiles/files/Manual_Water_Analysis_09_01_2017.pdf
2.	https://pdf.usaid.gov/pdf_docs/PNABY897.pdf
3.	https://www.scpscience.com/Company%20Literature/Pdf/Catalogs/wateranalysis%20vol2(Oct%207).pdf
4.	Jo https://pubs.usgs.gov/twri/05a01-1979/report.pdf

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) tothe minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom'sTaxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	FUNDAMENTALS OF GEOLOGY	Naan Mudh alvan		-	-	-	2		-	100	100

Course Objectives	
CO1	Remember the earth and composition
CO2	Understand the various minerals properties
CO3	Apply the concepts of structural geology
CO4	Analyze the rock types
CO5	Evaluate the water movements

Unit	Details	No. of Hours	Course Objectives
I	A brief account of various theories regarding the origin of earth. Interior of the Earth: an outline of the composition and constitution of the interior of earth. Age of the earth. Fossils: Definition, conditions required for fossilization, Modes of preservation, Uses of fossils. General Stratigraphy: Principles of Stratigraphy, – Time Units – Time rock Units – Standard Geological Time scale.		CO1
II	Mineralogy: Definition, Characters and Uses -Physical Properties of Minerals: Colour, streak, luster, hardness, habit, cleavage, fracture, Odour, fluorescence and Phosphorescence, feel, tenacity, specific gravity, magnetism. Chemistry of minerals: general principals of chemical properties of minerals: atom, ions, molecules, atomic number, mass number, valence, ionic radii–bonding in minerals–atomic substitution and solid solution-Isomorphism, polymorphism and pseudo morphism.		CO2
III	Introduction to structural geology: Methods of representing physiographic features: graphical method, topographic map, contours and its characters and Geological maps. Beds and their attitudes: Dip and strike and its importance- Relation between true and apparent dips. Width of outcrops, True thickness, vertical thickness and their mutual relations. Clino compass and Brunton compass and its uses.		CO3
IV	Rocks – Classification into Igneous, Sedimentary and Metamorphic groups. Distribution of elements in the		CO4

	crust – Divisions of igneous rocks as plutonic, hypabyssal and volcanic – Intrusive and extrusive forms – Structures. Structure and textures of sedimentary rocks. Definition – Agents and kinds of metamorphism – structure and textures – Depth zones – A brief study of Facies and grades.		
V	Definition of hydrogeology and groundwater – Hydrological cycle -Types of groundwater based on origin -Vertical distribution of groundwater – Types of water bearing formations: aquifers, aquitards, aquifuge and aquicludes - Types Aquifers: Confined, unconfined, semi-confined, and perched. Definition of ore, tenor, grade and metallic and non-metallic minerals. Geological thermometry — Classification of ore deposits, (Lindgren and Bateman).		CO5
	Total		

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Recollect the earth and composition	PO1
CO2	Appreciate the various minerals properties	PO1, PO2
CO3	Apply the concepts of structural geology	PO4, PO6
CO4	Scrutinize the rock types	PO4, PO5, PO6
CO5	Appraise the water movements	PO3, PO8

Text Books
(Latest Editions)

1.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)
2.	Invertebrate Palaeontology - H. Woods, (1985), CBS Publishers and Distributors, New Delhi.
3.	Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi
4.	Read, H.H. (1916). Routley's elements of Mineralogy, Thomas Murphy & co,. London.
5.	Ford, W.E. (1988). Dana's Text book of Mineralogy. Wiley. New Delhi. (Reprint).

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Ragan, D. M. (2000). Structural Geology An Introduction to Geometrical

	Techniques. Wiley. NewYork.
2.	Billings M. P (1974). Structural Geology, Prentice Hall, New Delhi.
3.	Best, M. G, Igneous and Metamorphic Petrology, Wiley. New Delhi (2003)
4.	TyreII, G. W, Principles of Petrology, B .I. Publications New Delhi(1958)
5.	Raghunath, H. M. (1988). Groundwater. East West Pub. Delhi.
6.	Ramakrishnan, S. (2011). GroundWater. Scitech Publications. Chennai.
Web Resources	
1.	https://arvindguptatoys.com/arvindgupta/vp-planet-earth.pdf
2.	*https://www.ocean.washington.edu/courses/oc410/reading/RogerAnderson/Planet_Earth_Topic_3.pdf*

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Semester-IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Structural Geology	Core	Y	-	-	-	4	4	25	75	100
Course Objectives											
CO1	Remember the earth's surface and its structural features										
CO2	Understand various types of forces involved in deformation of rocks and describe attitude of structures										
CO3	Apply the basic concepts to distinguish the types of deformational structures										
CO4	Analyze deformational structures produced by various deformational processes										
CO5	Evaluate the regional tectonic and deformation processes										
Unit	**Details**							**No. of Hours**		**Course Objectives**	
I	Introduction to structural geology: Pioneers of structural geology, scope and aim of Structural Geology. Methods of representing physiographic features: graphical method, topographic map, contours and its characters and Geological maps. Beds and their attitudes: Dip and strike and its importance- Relation between true and apparent dips. Width of outcrops, True thickness, vertical thickness and their mutual relations. Measurement techniques of dip and strike using clinometer and Brunton compass							12		CO1	
II	Physical properties of rocks: deformation, forces causing deformation: Compressional force, Tensional force, and Shearing force**.** Types of deformation: brittle, plastic and elastic –factors affecting rock deformation. Geological Field work: Basics of Field Geology, Planning for Field work: Objectives, Preparation, Field Equipment's-Field Safety Measures. Recognition of Rocks -Measurements of Structural: Features, Locating your position- measuring dip and strike, Plotting attitude of beds -Specimen collection - Field Sketchesand Photographs - Documentation of Field Observations. Erosional structures: Inlier and Outlier, Klippe and Fenster, Synclinal hill and Anticlinal valley.							12		CO2	
III	Fold – Definition and elements of fold - Classification of folds-causes and mechanism offolding: tectonic and non-tectonic, criteria for recognition of folds-							12		CO3	

	importance of folds, definition, types. Fault: Definition – importance of faults - elements of faults – classification of faults: mechanism and genetic - causes of faults - criteria for reorganization of fault, Importance of fault, Fault zone terminology.		
IV	Joint: Definition, Joint system, element and classification: genetic and geometric-mechanism and causes of joints. Criteria for reorganization of joints - importance of joints. Unconformity: definition, classification, recognition of unconformity, significance.	12	CO4
V	Cleavage and Schistosity: Types and origin of rock cleavages, Types of rock cleavage, cracks and fissures. Lineation*:* Kinds and Origin of lineation-Tectonic significance oflineation.	12	CO5
	Total	**60**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit.
There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the earth's surface and its structural features	PO1
CO2	Understand various types of forces involved in deformation of rocks and describe attitude of structures	PO1, PO2
CO3	Apply the basic concepts to distinguish the types of deformational structures	PO4, PO6
CO4	Analyze deformational structures produced by various deformational processes	PO4, PO5, PO6
CO5	Evaluate the regional tectonic and deformation processes	PO3, PO8

Text Books
(Latest Editions)

1. Billings M. P (1974). Structural Geology, Prentice Hall, New Delhi.
2. Ragan, D. M. (2000). Structural Geology An Introduction to Geometrical Techniques. Wiley. NewYork.
3. Hobbs, B. E, Means, W. D &William, P. F (1976). An outline of structural geology, John Wiley, New York.
4. De Sitter, L. U. (1956). Structural geology, McGraw Hill, New York.
5. Gosh, S. K. (1993). Structural Geology fundamentals and modern developments.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Compton R. R. (1985). Geology in the Field, John Wiley & Sons Inc., New Delhi.
2.	Sathya Narayanaswami, B.S. (1994). Structural Geology. Dhanpat Rai & Sons. NewDelhi.
3.	Gokhale, N. W.(1995), Theory of Structural Geology, CBS, Delhi.
4.	Hills, E. S. (1963). Elements of Structural Geology, Chapman & Hall. London.
5.	Park, P. G. (1983). Foundations of Structural Geology, Blackie, London.
Web Resources	
1.	Structural Geology & Map Interpretationhttps://ocw.tudelft.nl/courses/structural-geology-map-interpretation/
2.	https://www.sepm.org/
3.	https://www.geosocindia.org/
4.	https://open.umn.edu/opentextbooks/textbooks/899
5.	https://isegndia.org/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Structural Geology Practical	Core	Y	-	-	-	4	2	50	50	100

Course Objectives	
CO1	Understand the basics components of Structural Geology
CO2	Know the formations of geological formations
CO3	Understand the basics concepts of mapping
CO4	Interpretation of geomorphological features
CO5	Usage of compasses and GPS

Unit	Details	No. of Hours	Course Objectives
I	Contour Maps and their interpretation – Exercises to find out trend of the outcrop of horizontal, vertical, inclined beds with respect to topography – Reading of solid, conformable maps – Deciphering dip and strike of outcrops - Completion of map when three points over a bedding plane are given – Determination of vertical thickness of formations.	6	CO1
II	Reading of solid fold and fault maps – Determination of throw of faults – Construction of vertical sections – Reading of unconformable solid maps – Construction of sections – Reading of solid maps of areas with more than one structure and intrusion – Writing of geological history.	6	CO2
III	Solving of dip and strike problems by trignometrical method – Determination of true thickness of beds by calculations	6	CO3
IV	Interpretation of geomorphology, lithology and geological structures on aerial photographs. Visit to nearby geological organizations	6	CO4
V	Definition – Compass survey – description of compass – whole circle bearings – reduced bearings – quadrantal bearings – open traverse – closed traverse – finding distance between inaccessible stations – locating the instrument station - GPS - Clinometer compass – finding dip and strike of beds – Modern Surveying	6	CO5
	Total	**30**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.

Each course outcome should be mapped with the POs. The mapping of each CO can be done with any number of POs.		
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basics components of Structural Geology	PO1
CO2	Know the formations of geological formations	PO1, PO2
CO3	Understand the basics concepts of mapping	PO4, PO6
CO4	Interpretation of geomorphological features	PO4, PO5, PO6
CO5	Usage of compasses and GPS	PO3, PO8
Text Books (Latest Editions)		
1.	Gokhale, N. W, Theory of Structural Geology, CBS, Delhi (1995)	
2.	Sathya Narayanaswami, B. S. Structural Geology. Dhanpat Rai & Sons. New Delhi. (1994)	
3.	LiIIisand T. M & R. W. Kiefer, Remote Sensing and Image Interpretation, Wile Delhi (2000)	
4.	Reddy A, Principles of Remote Sensing and GIS, CBS. Delhi (2010)	
5.	Subramanian, Surveying and Levelling, Oxford University Press (2nd edition)	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Park, P. G., Foundations of Structural Geology, BIackie. London (1983).	
2.	Mahapatra G. B. Textbook of Physical Geology, CBS publications, Delhi (1994).	
3.	Ragan D. M., Structural Geology-An Introduction to geometrical Techniques. Wiley. New York (2000)	
4.	Guptha, R. P, Remote Sensing Geology, Springer New Delhi (2003)	
5.	T.P. Kanetkarand S.V, Kulkarni, Surveying and Levelling Vol. I and Vol. II, Pune Vidyarthi Griha Prakashan 2006	
Web Resources		
1.	http://www.labotka.net	
2.	http://www.patnasciencecollege.org	
3.	www.wamis.org	
4.	www.sciencedirect.com>earth-and-planetaryh-sciences	
5.	https://www.geo.cornell.edu	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Elements of Geochemistry	SEC	Y	-	-	-	1	2	25	75	100

Course Objectives	
CO1	Understand the principles of geochemistry
CO2	Apply the geochemistry concepts in prospecting of economically important deposits.
CO3	Analyse the various chemical properties of the earth
CO4	Evaluate geochemical character of rocks.
CO5	Create a geochemical character map of the region

Unit	Details	No. of Hours	Course Objectives
I	Introduction – Periodic table, Geochemistry of the Earth; Formation of the solar system and geochemical history of the earth. The geochemical cycle- Distribution of elements in rocks and soils.	6	CO1
II	Oddo-Harkin's Law, Basic concepts and speciation in solutions, Eh, pH relations - Elements ofmarine chemistry- Mineral reactions- diagenesis and hydrothermal reactions.	6	CO2
III	Meteorites, Chondrites and chodurites. Geochemical classification of elements. Distributionof elements in the geosphere. Geochemical affinity.	6	CO3
IV	Geochemical Properties of elements: volatiles, semi-volatiles, alkalis, alkaline earths, REE, HFS, Transition metals and noble metals and Trace elements. Radioactive and Stable Isotopes and its application in geoscience - litho geochemical and hydrogeochemical methods.	6	CO4
V	Radioactive Decay, Determining Isotope Decay time, Potassium-Argon Systematics, Uranium- Thorium-Lead Systematics. Types of Isotope- Fractionation, isotope Exchange between minerals and water, Carbon, Oxygen and Sulphur isotopes, First-order decay and growth equations.	6	CO5
	Total	**30**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.

The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the principles of geochemistry	PO1
CO2	Apply the Geochemistry concepts in prospecting of economically important deposits.	PO1, PO2
CO3	Analyse the various chemical properties of the earth	PO4, PO6
CO4	Evaluate geochemical character of rocks.	PO4, PO5, PO6
CO5	Create a geochemical character map of the region	PO3, PO8

Text Books
(Latest Editions)

1.	Mason, B. and Moore, C. B., 1991, Introduction to Geochemistry, Wiley Eastern.
2.	Krauskopf, K. B., 1967, Introduction to geochemistry, McGraw Hill.
3.	Faure, G.,1986, Principles of isotope Geology., John Wiley.
4.	Hoefs, J., 1980, Stable Isotope Geochemistry., Springer Verlag
5.	Brounlow, A. N. 1979. Geochemistry, Prentice hall.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	John V. Walther, Essentials of Geochemistry, Jones and Bartlett Publishers, 2005, Bosto
2.	Girard, Principles of Environmental Chemistry, Jones and Bartlett Publishers, 2005, Boston.
3.	Arthur Brownlow, Geochemistry (Second edition), Pearson Education, INC., Australia, 1996
4.	Torling, D. H., 1981, Economic Geology and Geotectonics., Blackwell Sci Publ.
5.	Barnes, H. L., 1979, Geochemistry of Hydrothermal Ore Deposits., John Wiley

Web Resources

1.	https://www.sepm.org/
2.	https://www.geosocindia.org/
3.	https://open.umn.edu/opentextbooks/textbooks/899
4.	https://isegndia.org/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Earth and Climate	Naan Mudhalvan		-	-	-	2		-	100	100

Course Objectives	
CO1	Remember the interaction between the atmosphere and the earth's surface
CO2	Understand the importance of the atmospheric pressure and winds
CO3	Apply the atmospheric moisture works
CO4	Analyse the cyclones and its impacts.
CO5	Evaluate and seasonal and regional climate variations

Unit	Details	No. of Hours	Course Objectives
I	Introduction to climatology: physical elements of weather and climate: - Fundamental principles of climatology, Atmosphere, Climate system: Components of the climate system - Climate controlling factors. Earth's radiation balance – longitudinal and seasonal variation of insolation.		CO1
II	Atmospheric moisture and Precipitation: - hydrological cycle - Precipitation and Rainfall: Types and measurements. Weather elements: Temperature, pressure, humidity, clouds, wind, sunshine and rainfall – monsoon patterns.		CO2
III	Atmospheric Pressure: Diurnal and Seasonal Variations – Vertical and Horizontal distribution and factors affecting - Pressure Gradient - Coriolis force and Deflection. Winds: Causes and Types - Jet stream, planetary winds, Monsoon and Local winds. Cyclones – Definition, types and their effects and geographic distribution.		CO3
IV	Classification of climates –Koppen's and Thornthwaite's scheme of classification –climate change. Ocean circulation, pattern and its climate control.		CO4
V	Global warming: Definition, greenhouse effect, greenhouse gases, Impact of climate change, prevention of global warming Acid rain: Definition, causes, formation, affected area, effects and preventive measures. Ozone depletion: Definition, effects and preventive measures.		CO5
	Total		

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the interaction between the atmosphere and the earth's surface	PO1
CO2	Understand the importance of the atmospheric pressure and winds	PO1, PO2
CO3	Apply the atmospheric moisture works	PO4, PO6
CO4	Analyse the cyclones and its impacts.	PO4, PO5, PO6
CO5	Evaluate and seasonal and regional climate variations	PO3, PO8

Text Books
(Latest Editions)

1.	Montgomery, C.W. (1989) Environmental Geology. Brown Publishers, Dubuque, Iowa, USA.
2.	Strahler, A.N. and Strahler, A.H. (1973) Environmental Geoscience – Interaction between Natural Systems and Man. Hamilton Publishing Co., Santa Barbara, California.
3.	Kudesia, V.P. (1980) Water Pollution. Pragathi Prakasam, Meerut.
4.	Kothandaraman, H. (1997) Principles of Environmental Chemistry. BI Publications Pvt. Ltd., Chennai.
5.	Black, W. (1972) Atmospheric Pollution. McGraw-Hill Co., New York.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Trivedy, R.K. and Goel, P.K. (1986) Chemical and Biological Methods for Pollution Studies. Environmental Publications, Karad, Maharashtra.
2.	Fairbridge, R.W. (1972) Encyclopedia of Geochemistry and Environmental Science. John Wiley.
3.	Datta, M. and Singh, N.P. et al. (Eds.) (2008) Climate Change and Food Security. New Delhi Publishing Agency.
4.	Shyam, S., Verma, H.N. and Bhargava, S.K. (2006) Air Pollution and its Impacts on Plant Growth. New Delhi Publishing Agency
5.	Andreas Schmittner (2018) Introduction to Climate Science, Oregon State University.

Web Resources

1.	https://open.umn.edu/opentextbooks/textbooks/860
2.	
3.	
4.	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Semester - V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Igneous petrology	Core	Y	-	-	-	4	5	25	75	100
Course Objectives											
CO1	Understand the basic principles of Petrology										
CO2	Know the textures and micro-structures										
CO3	Know about the composition of magma and various system of rock formation										
CO4	Understand the petrological characters of rocks										
CO5	Understand the origin of various rock types										

Unit	Details	No. of Hours	Course Objectives
I	Rocks – Classification into Igneous, Sedimentary and Metamorphic groups. Distribution of elements in the crust – Divisions of igneous rocks as plutonic, hypabyssal and volcanic – Intrusive and extrusive forms – Structures.	15	CO1
II	Textures and Microstructures – Classification of Igneous rocks (Tyrell and Streikeisen).	15	CO2
III	Composition and constitution of magma – Study of unicomponent magma – Binary system: Diopside and Anorthite, Albite and Anorthite, and Forsterite and Silica systems – Ternary System represented by Albite – Anorthite – Diopside – Bowen's reaction principle	15	CO3
IV	Petrographic characters of Granites, Diorites, Syenites, Gabbros, Dolerite, Basalt, Pegmatites, Aplites and Lamprophyres.	15	CO4
V	Origin of igneous rocks - Differentiation – Assimilation, - Petrography of special rock types, Anorthosite and Carbonatites.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic principles of Petrology	PO1
CO2	Know the textures and micro-structures	PO1, PO2
CO3	Know about the composition of magma and various system of rock formation	PO4, PO6
CO4	Understand the petrological characters of rocks	PO4, PO5, PO6
CO5	Understand the origin of various rock types	PO3, PO8
Text Books (Latest Editions)		
1.	Best, M. G, Igneous and Metamorphic Petrology, Wiley. New Delhi (2003)	
2.	Mcbirney A. R, Igneous Petrology, CBS New Delhi (1993)	
3.	Best M. G, Igneous Petrology. Wiley. New Delhi (2005)	
4.	Hatch, F. H. et al, Petrology of the Igneous Rooks, CBS Delhi.	
5.	Hyndman D. W, Petrology of the Igneous and Metamorphic Rocks McGrawHill. NewYork (1985)	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	TyreII, G. W, Principles of Petrology, B .I. Publications New Delhi(1958)	
2.	Haung, W. T, Petrology, McGraw Hill. New York (1962)	
3.	Winter, J. D, Principles of Igneous and Metamorphic Petrology, PHI. New Delhi	
4.	Middlemost E. A. K, Magmas and Magmatic Rocks. Longman UK (1985)	
5.	Winkler, H. G. F, Petrology of the Metamorphic Rocks. Springer, New Delhi (1970)	
Web Resources		
1.	https://minerva.union.edu/hollochk/c-petrology/resources.html	
2.	https://topex.ucsd.edu/es10/lecture/lecture10/lecture10.html	
3.	https://geology.com/rocks/igneous-rocks.shtml	
4.	https://course.lumenlearning.com/wmopen-geology/chapter/outcome-metamorphic-rocks/	
5.	https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/10875.html	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Sedimentary and metamorphic Petrology	Core	Y	-	-	-	4	5	25	75	100

Course Objectives	
CO1	Understand the basic principles of Petrology
CO2	Know the macro and micro-structures
CO3	Know various agents of sedimentary and metamorphic petrology
CO4	Understand the petrological characters of rocks
CO5	Understand the origin of various rock types

Unit	Details	No. of Hours	Course Objectives
I	Classification (Tyrrel and Pettijohn) – Structures – Descriptive Petrography of Residual sediments.	15	CO1
II	Descriptive Petrography of clastic - Arenaceous, Argillaceous and Rudaceous - Chemical and Organic deposits.	15	CO2
III	Definition – Agents and kinds of metamorphism – structure and textures – Depth zones – A brief study of Facies and grades.	15	CO3
IV	Cataclastic metamorphism and its products, thermal and dynamothermal metamorphism on Quartzo Felspathic, argillaceous, calcareous and basic igneous rocks.	15	CO4
V	Plutonic metamorphism on Quartzo-felspathic, argillaceous, calcareous and basic igneous rocks – Charnockites – Metasomatism – A brief account of migmatites – Anatexis and palingenesis and retrogressive metamorphism.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic principles of Petrology	PO1
CO2	Know the macro and micro-structures	PO1, PO2

CO3	Know various agents of sedimentary and metamorphic petrology	PO4, PO6
CO4	Understand the petrological characters of rocks	PO4, PO5, PO6
CO5	Understand the origin of various rock types	PO3, PO8
Text Books (Latest Editions)		
1.	Principles of Petrology, G.W. Tyrrel, (1985), C.B.S Publishers and Distributors, Delhi	
2.	Petrology for sediments, S.R. Nockolds, R.W.O.Knott& G.A Chinner, (1979), Cambridge University Press, London.	
3.	Green smith J. T, Petrology of the Sedimentary Rocks, CBS.Delhi(1976).	
4.	WiIliams, H. et al, Petrography, CBS. New Delhi (1982)	
5.	Haung, W. T, Petrology, McGraw Hill. New York (1962)	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Metamorphism, B. Baskar Rao, (1986), Oxford I.B.D., New Delhi.	
2.	Petrography, H. William, F.J. Turner & C.M. Gilbert, (1954) San Francisco.	
3.	Introduction to Sedimentology, Sengupta. S. M, (2007), CBS Publishers & Distributors, New Delhi.	
4.	TyreII, G. W, Principles of Petrology, B. I. Publications. New Delhi (1958)	
5.	FoIk, R. L, Petrology of the Sedimentary Rocks. Hemphill. Texas. USA (1974)	
Web Resources		
1.	https://www.britannica.com/science/geology/sedimentary-petrology	
2.	https://limk.springer.com/chapter/10	
3.	https://www.geo.mtu.edu/UPSeis/hazards.html	
4.	https://www.omafra.gov.on.ca/english/engineer/facts/	
5.	https://geology.com/rocks/rock-salt.shtml	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Hydrogeology	Core	Y	-	-	-	4	5	25	75	100
Course Objectives											
CO1	Understand Specific yield and specific retention and basic concepts related to fluid motion in porous media.										
CO2	Apply the methods to study Groundwater Quality and Chemistry										
CO3	Analyse the concept of aquifers and their boundaries										
CO4	Evaluate potential Groundwater exploration and hydrogeological survey.										
CO5	Create the filed report based on hydrogeological survey										
Unit	**Details**							**No. of Hours**	**Course Objectives**		
I	Definition of hydrogeology and groundwater – Hydrological cycle -Types of groundwater based on origin -Vertical distribution of groundwater – Types of water bearing formations: aquifers, aquitards, aquifuge and aquicludes - Types Aquifers: Confined, unconfined, semi-confined, and perched–Springs: types, geological conditions favoring development of springs - Artesian wells.							15	CO1		
II	Rock properties controlling groundwater: types of openings, porosity, specific yield, specific retention and permeability – Groundwater movement – Darcy's law and its applications –Determination of porosity and permeability in field and lab – Groundwater occurrence in igneous, sedimentary and metamorphic rocks.							15	CO2		
III	Exploration of groundwater: Geological, Remote sensing and geophysical methods-electrical resistivity method. Well types: Open wells, tube wells, jetted wells, infiltration galleries and collector wells. Well design and development – Fluctuations of groundwater – Groundwaterrechargemethods: natural and artificial methods.							15	CO3		
IV	Pump tests and evaluation of various aquifer parameters through pump tests – Conjunctive and consumptive use of groundwater –Sea water intrusion: causes, consequences and, preventive and control measures– Groundwater resources and its quality in Tamil Nadu.							15	CO4		
V	Groundwater quality in various rock types–Parameters considered for assessing groundwater quality, suitability for drinking and irrigation purposes – The latest drinking							15	CO5		

	and irrigation water standards of WHO and BIS – Rainwater harvesting methods – Watershed management.		
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand Specific yield and specific retention and basic concepts related to fluid motion in porous media.	PO1
CO2	Apply the methods to study Groundwater Quality and Chemistry	PO1, PO2
CO3	Analyse the concept of aquifers and their boundaries	PO4, PO6
CO4	Evaluate potential Groundwater exploration and hydrogeological survey.	PO4, PO5, PO6
CO5	Create the filed report based on hydrogeological survey	PO3, PO8

Text Books
(Latest Editions)

1.	Todd, D. K. (2008). Groundwater Hydrology. 5th ed. Wiley. New Delhi.
2.	Davis, S. N. & R. J. M. DeWiest. (1966). Hydrogeology. Wiley. Delhi.
3.	Freeze, R. A. & J. A. Cherry. (1979). Groundwater. Prentice Hall. New York.
4.	Raghunath, H. M. (1988). Groundwater. East West Pub. Delhi.
5.	Fetter, G. W. (1989). Applied Hydrogeology. CBS. Delhi

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Raghunath, H. M. (1985). Hydrology. East West Pub. Delhi
2.	Ramakrishnan, S. (2011). GroundWater. Scitech Publications. Chennai.
3.	Garg, S. P.(1982). Groundwater and Tube Wells. Oxford & IBH. Delhi.
4.	Murthy, K.S. (1998). Watershed management in India, 3rd edition, Wiley Eastern Ltd. New Age International Ltd, New Delhi, 198 p.
5.	Kevin M. (2005) Hiscock ***Hydrogeology:*** Principles and Practice, Blackwell Science Ltd.

Web Resources

1.	https://en.m.wikipedia.org/wiki/groundwater
2.	https://britannica.com/science/hydrology
3.	https://www.britannica.com/science/ground water

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Petrology and Hydrogeology Practical	Core	Y	-	-	-	3	5	50	50	100

Course Objectives	
CO1	Understand the basic Petrology
CO2	Know the macro and micro-structures
CO3	Know various agents of sedimentary and metamorphic petrology
CO4	Understand the Petrographical characters of rocks
CO5	Analyse Origin of various rock types

Unit	Details	No. of Hours	Course Objectives
I	Analysis of rainfall data, estimation of porosity, estimation of aquifer parameters, Darcy's law.	15	CO1
II	Find out the water bearing formation using resistivity data.	15	CO2
III	Megascopic identification and description of the following rocks: granite, graphic granite, pegmatite, aplite, orbicular granite, schorl rock, tourmaline rock, granite porphyry, Syenite, dolerite, gabbro, anorthosite, olivine, gabbro, dunite, pyroxenite, norite, dolerite porphyry, basalt, trachyte, rhyolite, vitrophyre, obsidian, pumice, scoria, pitchstone, volcanic tuff and volcanic breccia.	15	CO3
IV	Megascopic identification and description of the following: conglomerate, breccia, laterite, sandstone, arkose, greywacke, grit, shales, limestones, chert, flint, peat, bituminous coal, anthracite, lignite, chalk, gneisses, schist, phyllite, slates, quartzite, marble, amphibolite, eclogite, leptynite, khondalite, kodurite, gondite, charnockite, calc granulite and basic granulite.	15	CO4
V	Microscopic identification and description of the following: mica granite, hornblende granite, tourmaline granite, schorl rock, aplite, graphic granite, quartz syenite, mica syenite, hornblende syenite, nepheline syenite, quartz diorite, hornblende diorite, olivine gabbro, hypersthene gabbro, dunite, peridotite granite porphyry; syenite porphyry, diorite porphyry, quartz porphyry, dolerite, minette, anorthosite, rhyolite, trachyte, andesite, basalt, leucite, phonolite, nosean, and volcanic breccia.	15	CO5

	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic Petrology	PO1
CO2	Know the macro and micro-structures	PO1, PO2
CO3	Know various agents of sedimentary and metamorphic petrology	PO4, PO6
CO4	Understand the Petrographical characters of rocks	PO4, PO5, PO6
CO5	Analyse Origin of various rock types	PO3, PO8

Text Books
(Latest Editions)

1.	Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi
2.	Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi
3.	Krishnasamy S, India's Mineral Resources, Oxford & IBH. Delhi (1988)
4.	Sharma N. L & R. K.Sinha. Mineral Economics, Oxford & IBH. Delhi (1985)
5.	Prasad U, Economic Mineral Deposits, CBS. Delhi (2003)

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	India's Mineral Resoruces, Krishnaswamy.S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi
2.	Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V., (1970), Dhanbad publications, Dhanbad.
3.	Industrial Minerals, Sinha, R. K, (1986), Oxford 7 IBH Pub. Co., New Delhi.
4.	Craig,R.C& D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York (1985)
5.	Aiyengar, N. K. N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964).

Web Resources

1.	https://www.britannica.com/topic/economic-geology
2.	https://en.m.wikipedia.org/wiki/supergene-(geology)
3.	https://energymining.sa.gov.au/minerals/mineral-commodities
4.	https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology
5.	https://link.spring.com/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Stratigraphy	Elective	Y	-	-	-	3	4	25	75	100

Course Objectives	
CO1	Understand the Principles of Stratigraphy
CO2	Know the Important group of Stratigraphic systems
CO3	Know the economic importance of various periods
CO4	Understand the various rocks of different periods from the formation of Earth
CO5	Present is the Key to the Past – Critical Analyse

Unit	Details	No. of Hours	Course Objectives
I	General Stratigraphy: Principles of Stratigraphy, – Time Units – Time rock Units – Standard Geological Time scale. Indian Stratigraphy: Archaean: Dharwar Supergroup – Champian Gneiss – Peninsular Gneiss – Closepet Granite- Sakoli Series – Saucer Series – Bundelkhand Gneiss – Banded gneissic complex – Aravalli Supergroup – Raiolo Series - Singhbhum Iron ore Series – Singhbhum copper belt shear zone – Newer Dolerite – Mineral riches of Archaean.	12	CO1
II	Proterozoic: Cuddapah Supergroup – Kaladgi series – Delhi Supergroup – Erinpura Granite – Malani Igneous suite – Hazara slates – Attock slates – Dogra Slates – Mineral riches of Cuddapah – Vindyan Supergroup – Kurnool Supergroup – Bhima Series – Mineral riches of Vindhyan.	12	CO2
III	Palaeozoic: Cambrian of Salt range – Age of Saline series – Haimanta System – MuthQuartzites – Kanawar System – Fenestella Shales – Kuling System – Everest Limestone – Panjal Volcanic Series. Gondwana Supergroup – Climate and Sedimentation – Classification – Lithology – Fossil contents – Distribution of Coal Deposits.	12	CO3
IV	Mesozoic: Triassic of Spiti – Succession and fossil contents Jurassic of Kutch – Succession and fossil content – Cretaceous of Tiruchirapalli and Bagh beds. Cenozoic: Deccan traps – Age – Distribution – Petrology – Lametabeds – Infratrappean and Intertrappean beds	12	CO4
V	Tertiary of Assam and Tamilnadu Siwalik Supergroup –	12	CO5

	Varkala and Quilon beds of Kerala – Tertiary of Cambay a Karewa formation – Rise of Himalayas- Pleistocene Glaciation – Indo-Gangetic alluvium – Laterite.		
	Total	**60**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic of Historical Geology	PO1
CO2	Know the Important group of Stratigraphic systems	PO1, PO2
CO3	Know the economic importance of various periods	PO4, PO6
CO4	Understand the various rocks of different periods from the formation of Earth	PO4, PO5, PO6
CO5	Present is the Key to the Past – Critical Analyse	PO3, PO8

Text Books
(Latest Editions)

1.	Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi
2.	Geology of India, D.N. Wadia, (1966), McMillan company, London
3.	Vaidyanadhan. R & M. Ramakrishnan, Geology of India. Geological Society of India. Bangalore (2008)
4.	Mehdiratta R. C, Geology of India, Pakisthan, Bangladesh and Burma. Atma Ram & Sons. Delhi (1974)
5.	Geology& Mineral Resources of the States of India. Misc Pub.No.30. Geological Survey of India. Kolkata. (Several individual volumes available online at GSI portal) GSI (2005).

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Fundamentals of Historical Geology and Stratigraphy of India, Ravindrakumar (1985), Wiley Eastern ltd, New Delhi.
2.	Principle of Stratigraphy, Dunbar and Roggers, (1964), John Wiley and co, New York
3.	An Introduction in Stratigraphy, Stamp L.D, (1964), Thomas Murby, Museum St, WCI, London.
4.	Stratigraphic Principles and Practices, Weller, J.M, (1962), Harper & Bros, New York
5.	Kumar R, Fundamentals of Historical Geology and Stratigraphy of India, WiIey. New Delhi (1988).

Web Resources

1.	https://stratigraphy.org/
2.	https://www.sepm.org/
3.	https://www.geosocindia.org/
4.	https://www.moes.gov.in/
5.	https://isegindia.org/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	ENVIRONMENTAL GEOLOGY	Elective	Y	-	-	-	3	4	25	75	100

Course Objectives	
CO1	Understand the Basics of Environment
CO2	Know the Important of Atmosphere
CO3	Know the Environmental Pollution
CO4	Understand the Components of Hydrosphere
CO5	Apprise the Water Pollution

Unit	Details	No. of Hours	Course Objectives
I	Basics of Environment; Type of Environment; Man and Environment; Components of environmental Geology, Concepts and principles of Environmental Geology; Time scales of global changes in the ecosystem and climate.	12	CO1
II	Atmosphere, structure and composition of atmosphere; Global warming. Greenhouse effect: CO2 increase and global warming in the present and past atmospheres.	12	CO2
III	Environmental Pollution: Sources of Air Pollution, emission of major industrial air pollutants, effects of air pollution on atmospheric processes, oxides of carbon as pollutants, greenhouse effect, global warming, chlorofluro carbons (CFC's), depletion of ozone layer, effects of ozone depletion, smog, acid rain.	12	CO3
IV	Components of Hydrosphere; Water cycle; solubility of gases in water, Acidification of Ocean; Impact of oceanic and atmospheric circulation on climate and rain fall. Fluctuation of water table due to anthropogenic and geogenic causes.	12	CO4
V	Water Pollution: Types of water pollution, groundwater pollution and its effects, sources of water pollution; organic and inorganic contamination of groundwater and its remedial measures.	12	CO5
	Total	**60**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.		
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Comprehend the Basics of Environment	PO1
CO2	Distinguish the Important of Atmosphere	PO1, PO2
CO3	Recognize the Environmental Pollution	PO4, PO6
CO4	Appreciate the Components of Hydrosphere	PO4, PO5, PO6
CO5	Acquaint the Water Pollution	PO3, PO8
Text Books (Latest Editions)		
1.	Abhijit Dutta. Environmental Issues and Challenges	
2.	K. Sharma Environmental Pollution	
3.	Bell, F.G. (1999): Geological Hazards, Routledge, London.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Bryant, E. (1985): Natural Hazards, Cambridge Univ. Press.	
2.	Keller, E.A. (1978) Environmental Geology	
3.	Rekha Ghosh and D. S. Chatterjee: Environmental Geology	
Web Resources		
1.	https://www.hzu.edu.in/bed/E%20V%20S.pdf	
2.	https://www.sangameshwarcollege.ac.in/News/Environmental%20Studies%20%20E%20Book%20English_14012020052859/Environmenta%20Studies%20English%20Book.pdf	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Marine Geology	Elective	Y	-	-	-	3	4	25	75	100

Course Objectives	
CO1	Remember the marine landforms
CO2	Understand the development of landforms through Earth's external processes by various geological agents; marine processes and formation of marine landforms.
CO3	Apply the marine survey methods to understand ocean character
CO4	Analyze the waves, tides and its impacts
CO5	Evaluate the physical and chemical properties of marine water

Unit	Details	No. of Hours	Course Objectives
I	Definition, nature, scope of oceanography and its relationship with geology. Historical development of oceanography. Marine resources: Definition, types of physical resources, marine energy resources, biological resources, non-extractive resources. Principles and application of Echo sounder, Side scan sonar, Position fixing at Sea. Bottom sediment samplers.	12	CO1
II	Physical Oceanography: Salinity, conductivity, temperature, density, light and pressure of seawater-importance of physical characters of seawater. Chemical Oceanography: water molecule, dissolving power of Seawater, composition of sea water, major and minor elements in seawater, nutrients in the sea, dissolved gases in sea water, oxidation-reduction potential of seawater. Relationship between physical and chemical properties of seawater.	12	CO2
III	Mapping the Seafloor: Modern Bathymetric Techniques, Mapping the Ocean floor from space- Provinces of the Ocean Floor: continental margins: passive and active - continental rise- Abyssal Plains - Beaches and Shoreline.	12	CO3
IV	Waves: Definition, Parts of waves, Types of waves, Classification of waves and wave interactions with the shore. Tides: Definition, Classification and types. Ocean Currents: Definition types and causes. Littoral processes and Coastal Erosion. Types of coasts: erosional coast, depositional coasts, drowned coast, uplifted coast.	12	CO4
V	Introduction to the Law of Sea - Maritime Territory laws	12	CO5

	- Territorial Sea laws – EEZ. Introduction to Marine Pollution - Definition, types, sources of pollutions: sewage pollution, industrial wastage, oil pollution, toxic pollution, coastal and deep-sea pollution, - effect of pollutants.		
	Total	**60**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the marine landforms	PO1
CO2	Understand the development of landforms through Earth's external processes by various geological agents; marine processes and formation of marine landforms.	PO1, PO2
CO3	Apply the marine survey methods to understand ocean character	PO4, PO6
CO4	Analyze the waves, tides and tides and its impacts	PO4, PO5, PO6
CO5	Evaluate the physical and chemical properties of marine water	PO3, PO8

Text Books
(Latest Editions)

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: For Geographers, Cheytanya Publishing House, Allahabad.
5.	King, C. A. M. (1975). Oceanography for Geographers, E. Arnold, London.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Kuenen, (1950). Marine Geology. John Wileyand Sons.
2.	King, C. A. M (1975). Introduction to marine Geology and Geomorphology. Edward Arnold, London.
3.	Radhakrishnan, V (1996). General Geology V. V. P. Publishers, Tuticorin, 1996.
4.	Siddhartha, K. (2002). Oceanography:A Brief Introduction, Kisalaya Publications Pvt Ltd, 347p.
5.	Shepard, F. P (1978). Geological Oceanography, Heinmann, London.

Web Resources	
1.	Introduction to Physical Oceanographyhttps://open.umn.edu/opentextbooks/textbooks/introduction-to-physical-oceanography
2.	Paul Webb(2019) Introduction to Oceanography, Rebus CommUnityhttps://open.umn.edu/opentextbooks/textbooks/732
3.	https://www.ngdc.noaa.gov/mgg/
4.	https://www.iodp.org/
5.	https://www.nio.org/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	ENGINEERING GEOLOGY	Elective	Y	-	-	-	3	4	25	75	100

Course Objectives	
CO1	Remember the Engineering Geology and its applications
CO2	Understand the Rock Structure Rating and quality
CO3	Apply the knowledge of Dams and reservoirs
CO4	Analyze the Tunnels
CO5	Evaluate the Stability of rock slopes and cutting in rocks

Unit	Details	No. of Hours	Course Objectives
I	Engineering Geology and its applications, Scope of Engineering Geology; Elementary concepts of rock mechanics - Strength and Elastic properties. Engineering properties and characteristics of soils. Properties of building stones.	12	CO1
II	Basic concept of-Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR), Tunnelling Quality Index (Q).	12	CO2
III	Dams and reservoirs: Types of Dams-masonry or concrete dams- gravity, arch and buttress. Earth Dams and composite dams. Geological considerations-topography, structure and lithology. Foundation and seepage problems in dams and their treatment. Reservoir: Reservoir problems-seepage and silting.	12	CO3
IV	Tunnels: terminology, definition, types- hard rock and soft rock tunnels. Geological considerations- topography, structure and lithology. Bridge sites: Terminology, Bridge structure, types, bridge problems, and stability of bridges. Geology of bridge sites.	12	CO4
V	Stability of rock slopes and cutting in rocks: Classification of slopes- stable and unstable slopes-Geological parameters. Measures for stabilization of slopes. Foundation treatment; Grouting, Rock Bolting and other support mechanisms; soil stabilization.	12	CO5
	Total	**60**	

The course outcome is based on the course objectives. Each course objective will have a course

outcome. This will elucidate what the student will acquaint once he completes that particular Unit.
There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Recollect the Engineering Geology and its applications	PO1
CO2	Know the Rock Structure Rating and quality	PO1, PO2
CO3	Apply the knowledge of Dams and reservoirs	PO4, PO6
CO4	Scrutinize the Tunnels	PO4, PO5, PO6
CO5	Appraise the Stability of rock slopes and cutting in rocks	PO3, PO8
Text Books (Latest Editions)		
1.	Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique,	
2.	McGraw Hill (CBS Publ).	
3.	Johnson, R.B. and De Graf, J.V. 1988. Principles of Engineering Geology, John Wiley.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing. Bell, F.G, 2007. Engineering Geology, Butterworth-Heineman.	
Web Resources		
1.	https://www.geokniga.org/bookfiles/geokniga-engineering-geology.pdf	
2.	https://geomuseu.ist.utl.pt/SEMINAR2012/Livros/EngenhariaGeologica.pdf	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Internship / Industrial Training / Geological Field studies.			-	-	-	2	-	50	50	100

Course Objectives	
CO1	
CO2	
CO3	
CO4	
CO5	

Unit	Details	No. of Hours	Course Objectives
I	Students should be taken to the various geological field visit according to academic year syllabus in each year.		CO1
	Total		

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Students should understand geomorphology based on the various geological field visit.	PO1
CO2	They will acquire knowledge about the petrological formation.	PO1, PO2
CO3	They will know the structural features.	PO4, PO6
CO4	The students will understand stratigraphical sequence.	PO4, PO5, PO6
CO5	They will be trained how the economic minerals are mined.	They will be trained how the economic minerals are mined.

Text Books
(Latest Editions)

1.	Best, M. G, Igneous and Metamorphic Petrology, Wiley. New Delhi (2003)
2.	Mcbirney A. R, Igneous Petrology, CBS New Delhi (1993)

3.	Best M. G, Igneous Petrology. Wiley. New Delhi (2005)
4.	Hatch, F. H. et al, Petrology of the Igneous Rooks, CBS Delhi.
5.	Hyndman D. W, Petrology of the Igneous and Metamorphic Rocks McGraw Hill. New York (1985)
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	TyreII, G. W, Principles of Petrology, B.I.Publications New Delhi(1958)
2.	Haung, W. T, Petrology, McGraw Hill. New York (1962)
3.	Winter, J. D, Principles of Igneous and Metamorphic Petrology, PHI.New
4.	Middlemost E. A. K, Magmas and Magmatic Rocks. Longman UK (1985)
5.	Winkler, H. G. F, Petrology of the Metamorphic Rocks. Springer, New Delhi (1970)
Web Resources	
1.	https://minerva.union.edu/hollochk/c-petrology/resources.html
2.	https://topex.ucsd.edu/es10/lecture/lecture10/lecture10.html
3.	https://geology.com/rocks/igneous-rocks.shtml
4.	https://course.lumenlearning.com/wmopen-geology/chapter/outcome-metamorphic-rocks/
5.	https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/10875.html

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	GEOMORPHOLOGY	Naan Mudhalvan		-	-	-	2			100	100

Course Objectives	
CO1	Remember the Exogenic Processes
CO2	Understand the Geological agents
CO3	Apply the concepts of Hydrologic movements
CO4	Analyze the Oceans movement
CO5	Evaluate the Glaciers movements and landforms

Unit	Details	No. of Hours	Course Objectives
I	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.		CO1
II	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.		CO2
III	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.		CO3
IV	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.		CO4
V	Glaciers – Formation, movement and morphology. Types of glaciers. Erosion, transportation and deposition by glaciers. Glacial landforms. Global warming and its		CO5

	effects on glaciers. Wind – Geological action of winds. Landforms of Aeolian origin. Lakes – Origin, Classification, geologic significance.		
	Total		

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Reminisce the Exogenic Processes	PO1
CO2	Appreciate the Geological agents	PO1, PO2
CO3	Apply the concepts of Hydrologic movements	PO4, PO6
CO4	Scrutinize the Oceans movement	PO4, PO5, PO6
CO5	Appraise the Glaciers movements and landforms	PO3, PO8

Text Books
(Latest Editions)

1.	Pandey S. N. (1987) Principles and Applications of Photogeology, Wiley Eastern.
2.	Ahamed, E. (1972) Coastal Geomorphology of India. Orient Longman, New Delhi.
3.	Thornbury, W. D. (1968). Principles of Geomorphology, Wiley.
4.	Plummer, Carlson, McGeary (2003). Physical Geology. McGraw Hill.
5.	Weisberg, J, and Parish, H. (1974). Introductory Oceanography. McGraw Hill.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Arthur Holmes (1977) Principles of Physical Geology (Edinburgh: Thomas Nelson and Sons, 1944 and New York: Ronald Press, 1945.
2.	Bloom, A. (2004) Geomorphology – A Systematic analysis of Late Cenozoic Landforms (Third edition) Wavel and Press Inc.
3.	Vishwas S. Kale and Avjit Gupta (2000). Introduction to Geomorphology, Orient Black Swan.
4.	Sparks B. W. (1969). Geomorphology, Longman.

Web Resources

1.	https://sudartomas.wordpress.com/wpcontent/uploads/2012/11/fundamentalsofgeomorphology_routledgefundamentalsofphysicalgeography.pdf
2.	https://blogmedia.testbook.com/kmat-kerala/wp content/uploads/2023/06/geomorphology-downloaded-from-freejobapply.com_-365f1cfe.pdf

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Semester VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Economic Geology and Mineral Economics	Core	Y	-	-	-	4	6	25	75	100

Course Objectives	
CO1	Understand basics of Economic minerals
CO2	Know the various process of mineral formation
CO3	Know the various mode of mineral deposits
CO4	Know the physical and chemical characters of minerals
CO5	To understand various uses of minerals

Unit	Details	No. of Hours	Course Objectives
I	Definition of ore, tenor, grade and metallic and non-metallic minerals. Geological thermometry — Classification of ore deposits, (Lindgren and Bateman). Process of mineral formations – magmatic concentration – sublimation, contact metasomatism- Hydrothermal process – sedimentation – evaporation.	18	CO1
II	Processes of mineral formation: Residual and mechanical concentration – Oxidation and supergene sulphide enrichment – metamorphism. Coal deposits: Use, origin, Mode of Occurrence, distribution in India. Petroleum deposits: Origin and distribution in India. Mineralogy, origin, mode of occurrence, uses and distribution in India of the following: - Gold Deposits, Iron deposits, and copper deposits.	18	CO2
III	Mineralogy, origin, mode of occurrence, uses and distribution in India of the following: - manganese deposits, lead and zinc deposits, bauxite deposits and chromite deposits. Granite Industry I: Building stones – properties – cost, color, durability, crushing strength, transverse strength, absorption, density, frost and fire resistance, structural features, texture. Important building stones, physical and chemical properties and uses of granite, marble, limestone, sandstone, slate. Classification of commercial granites in precambrian terrain of south India.	18	CO3
IV	Physical properties, chemical composition, mode of occurrence and distribution in India of minerals required for the following industries: – Abrasives, fertilizers and	18	CO4

	refractory. Descriptive mineralogy, Mode of occurrence, uses, distribution in India of the following ores and industrial minerals: realgar, orpiment, cinnabar, fluorite, ilmenite, rutile, graphite, magnesite, asbestos and chrysotile.		
V	Granite Industry II: Granite blocks - quarrying techniques – pre-quarrying phase – operational phase – quarrying in earlier and recent times – blasting methodology – primary and secondary cutting – supporting machineries – problems encountered in granite mining. Granite trade, marketability, Resource estimation	18	CO5
	Total	**90**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basics of Minerals	PO1
CO2	Understand the importance of Minerals in Geological studies	PO1, PO2
CO3	Know different group of minerals systems	PO4, PO6
CO4	Understand the descriptive mineralogy of different groups	PO4, PO5, PO6
CO5	Understand the importance of Minerals and mineralogical studies	PO3, PO8

Text Books
(Latest Editions)

1.	Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi
2.	Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi
3.	Krishnasamy S, India's Mineral Resources, Oxford & IBH. Delhi (1988)
4.	Sharma N. L & R. K. Sinha. Mineral Economics, Oxford & IBH. Delhi(1985)
5.	Prasad U, Economic Mineral Deposits, CBS. Delhi (2003)

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	India's Mineral Resoruces, Krishnaswamy. S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi
2.	Introduction to Indian Economic minerals, Sharma, N.L and Ram, K. S. V.,

	(1970), Dhanbad publications, Dhanbad.
3.	Industrial Minerals, Sinha, R. K, (1986), Oxford 7 IBH Pub. Co., New Delhi.
4.	Craig, R. C & D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York (1985)
5.	Aiyengar, N. K. N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964).
Web Resources	
1.	https://www.britannica.com/topic/economic-geology
2.	https://en.m.wikipedia.org/wiki/supergene-(geology)
3.	https://energymining.sa.gov.au/minerals/mineral-commodities
4.	https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology
5.	https://link.spring.com/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Applied Geology	Core	Y	-	-	-	4	6	25	75	100
Course Objectives											
CO1	Understand the concepts of engineering geology and outline the applications of geology in engineering projects										
CO2	Apply the knowledge of soil properties in engineering projects.										
CO3	Apply the ore processing techniques										
CO4	Understand the coastal erosion and prevention methods										
CO5	Understand and study the environmental issues during the geological work										
Unit	**Details**							**No. of Hours**	**Course Objectives**		
I	Engineering Geology: Dams, Reservoirs and Tunnels – Brief description of the types of dam, Reservoir, spillways, Tunnels, bridges and highways. Engineering properties of Rocks: Various engineering properties of rocks- compressive, tensile, shear and triaxial strength of rock. Behavior of rock under stress/strain. Various building stones used as construction material.							18	CO1		
II	Soil – Definition -types of soils - formation of soils - Soil size parameters for buildingconstruction – expensive soil and its problem for building construction. Dam Construction: Types of Dams, Geological factors for consideration for dams and reservoirs sites selectionprocess-Dam foundation problems -criteriafor Reservoirsiteselection							18	CO2		
III	Sampling – Principles – types – collection of sample – core samples and their preservation. Methods of breaking rocks: short note on explosives. Outline of the method of metal mining. Open cast and underground mining. Alluvial mining: Principles and scope of ore dressing, Physical and chemical properties of ore dressing: crushers, grinders, and classifiers, Concentration of ore minerals by magneto–electrostatic and floatation processes.							18	CO3		
IV	Coastal erosion: types of erosion - Planning and methods of coastprotection works -Coastal protection structures –Remote sensing techniques forcoastalstudies. Applications of Geostatistics in Geotechnical studies: Graphical representation of data-Correlation – Principal componentanalysis – cluster							18	CO4		

	analysis. Application of Geophysics in Engineering projects.		
V	Environmental Geology: Environmental science – Introduction; Environmental impacts due to mining and mineral process. A short account of renewable and non-renewable resources. Effects of urbanization on surface and subsurface water- causes for ground water pollution.	18	CO5
	Total	**90**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the concepts of engineering geology and outline the applications of geology in engineering projects	PO1
CO2	Apply the knowledge of soil properties in engineering projects.	PO1, PO2
CO3	Apply the ore processing techniques	PO4, PO6
CO4	Understand the coastal erosion and prevention methods	PO4, PO5, PO6
CO5	Understand and study the environmental issues during the geological work	PO3, PO8

Text Books
(Latest Editions)

1.	Bell, F. G. (2005). Fundamentals of Engineering Geology. B. S. Publications, Hyderabad.
2.	Principles of Engineering Geology, K M Banger.
3.	Krynine, P. D.& W.R. Judd. (1956). Principles of Engineering Geology & Geotechnics. CBS. Delhi.
4.	Legget, R. F. & A. W. Hatheway. (1988). Geology and Engineering. 3rd ed. McGraw Hill. New York.
5.	Blyth, F. G. H. & M. H. De Freitas. (1984).A Geology for Engineers. 7th ed. Elsevier.NewDelhi.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Johnson, R. B. and DeGraf, J. V. 1988. Principles of Engineering Geology, John Wiley & Sons, New York.
2.	Goodman, R.E., 1993. Engineering Geology: Rock in Engineering constructions. Jonh Wiley & Sons, New York.
3.	Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.) Taylor & Francis
4.	Miller T. G. Environmental Science. Wadsworth Publishing. US (2004).
5.	Coates, D. R. Environmental Geology. McGraw Hill. New York (1984)
Web Resources	
1.	https://www.britannica.com/science/geology/properties of rocks
2.	https://limk.springer.com/chapter
3.	https://www.geo.mtu.edu/UPSeis/hazards.html
4.	https://www.omafra.gov.on.ca/english/engineer/facts/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Economic Geology and Ore Analysis & Applied Geology Practical	core	Y	-	-	-	3	5	50	50	100

Course Objectives	
CO1	Understand the basics of Minerals
CO2	Understand the importance of Minerals in Geological studies
CO3	Know different group of minerals systems
CO4	Understand the descriptive mineralogy of different groups
CO5	Understand the importance of Minerals and mineralogical studies

Unit	Details	No. of Hours	Course Objectives
I	Megascopic identification, description of visible characteristics, mode of occurrence and uses of the following ores: galena, anglesite, cerusite, sphalerite, zincite, willemite, bornite, azurite, chalcopyrite, cuprite, malachite.	15	CO1
II	Megascopic identification, description of visible characteristics, mode of occurrence and uses of the following ores: haematite, magnetite, siderite, goethite, pyrolusite, psilomelane, rhodochrosite, rhodonite, chromite, cinnabar, bauxite, realgar, orpiment, stibnite, molybdenite, pyrite, coal and its varieties.	15	CO2
III	Megascopic identification and description of: monazite, samarskite, columbite, tantalite, beryl, zircon, Megascopic identification and description of the following minerals used for industrial purposes – magnesite, calcite, dolomite, gypsum, strontianite, celestite, fluorite, apatite.	15	CO3
IV	Megascopic identification and description of the following minerals used for industrial purposes: barite, witherite, limonite, asbestos, quartz, feldspar, kaolin, garnet, rutile and ilmenite.	15	CO4
V	Identification of the following mineral powders by blowpipe methods: galena, chalcopyrite, haematite, magnetite, celestite, strontianite, witherite, gypsum, bauxite, apatite, pyrite, siderite, orpiment, realgar, calcite, psilomelane, rhodochrosite, smithsonite and ilmenite.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basics of Minerals	
CO2	Understand the importance of Minerals in Geological studies	
CO3	Know different group of minerals systems	
CO4	Understand the descriptive mineralogy of different groups	
CO5	Understand the importance of Minerals and mineralogical studies	

Text Books (Latest Editions)	
1.	Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi
2.	Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi
3.	Krishnasamy S, India's Mineral Resources, Oxford & IBH. Delhi (1988)
4.	Sharma N. L & R. K. Sinha. Mineral Economics, Oxford & IBH. Delhi (1985)
5.	Prasad U, Economic Mineral Deposits, CBS. Delhi (2003)
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	India's Mineral Resoruces, Krishnaswamy. S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi
2.	Introduction to Indian Economic minerals, Sharma, N.L and Ram, K. S. V., (1970), Dhanbad publications, Dhanbad.
3.	Industrial Minerals, Sinha, R.K, (1986), Oxford 7 IBH Pub. Co., New Delhi.
4.	Craig, R. C & D. V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York (1985).
5.	Aiyengar, N. K. N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964).
Web Resources	
1.	https://www.britannica.com/topic/economic-geology
2.	https://en.m.wikipedia.org/wiki/supergene-(geology)
3.	https://energymining.sa.gov.au/minerals/mineral-commodities

4.	https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology
5.	https://link.spring.com/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Regional Geology	Elective	Y	-	-	-	3	5	25	75	100

Course Objectives	
CO1	Understand various geological formations at regional scale
CO2	Know the important stratigraphic landforms
CO3	Know various economic importance of regional geology
CO4	Know the mode of occurrence and uses of minerals
CO5	To predict mineral formations in an unknown region.

Unit	Details	No. of Hours	Course Objectives
I	Geomorphology: Tectonic and Shear Zones of Tamil Nadu -Physiography – The Western and Eastern Ghats of Tamilnadu and their structural aspects. The Cauvery and Tambraparani Rivers – Soil types of Tamil Nadu.	15	CO1
II	Archaean Group – Anorthosites of Sittampundi, Kadavur and Oddanchatram – Alkali Rocks of Sivanmalai, Cordierite Sillimanite rocks of Trichy and Madurai, Charnockites of Pallavaram-Thiruttani Dyke swarms.	15	CO2
III	Gondwana Supergroup – Sriperumbudur beds and Therany clay beds - Cretaceous of Trichy District – Cenomanian Marine transgression –Tertiary group of Cauvery basins. Distribution of petroleum and natural gas in Tamil Nadu.	15	CO3
IV	Cuddalore Sandstone, Neyveli Lignite Deposits - Mode of occurrence & distribution of precious and Semi - precious stones in Tamil Nadu. Distribution of commercial granites, Heavy mineral sands (Zircon, Rutile, Ilmenite and Garnet) and Thorium deposits of Manavalakurichi in Tamil Nadu.	15	CO4
V	Mode of occurrence, uses, origin, and distribution in Tamil Nadu of the followings mineral deposit: Iron ores of Kanjamalai, Gauthimalai; Magnesite deposits of Chalk hills; Bauxite deposits of Shaveroy hill; Graphite beds of Sivaganga- Silica Sands of coastal areas in Kanchipuram, Thiruvallur, Cuddalore and Nagapattinam districts- River sand deposits of Tamil Nadu.	15	CO5
	Total	**75**	

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There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic of Historical Geology	PO1
CO2	Know the Important group of Stratigraphic systems	PO1, PO2
CO3	Know various economic importance of various periods	PO4, PO6
CO4	Understand the various rocks of different periods from the formation of Earth	PO4, PO5, PO6
CO5	Present is the Key to the Past – Critical Analyse	PO3, PO8

Text Books
(Latest Editions)

1.	Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi
2.	Geology of India, D.N. Wadia, (1966), McMillan company, London
3.	Vaidyanadhan. R & M.Ramakrishnan, Geology of India. Geological Society of India. Bangalore (2008)
4.	Geology& Mineral Resources of the States of India. Misc Pub.No.30. Geological Survey of India. Kolkata. (Several individual volumes available online at GSI portal) GSI (2005).
5.	Kumar R, Fundamentals of Historical Geology and Stratigraphy of India, WiIey. New Delhi (1988).

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Fundamentals of Historical Geology and Stratigraphy of India, Ravindrakumar (1985), Wiley Eastern ltd, New Delhi.
2.	Principle of Stratigraphy, Dunbar and Roggers, (1964), John Wiley and co, New York
3.	An Introduction in Stratigraphy, Stamp L.D, (1964), Thomas Murby, Museum St, WCI, London.
4.	Stratigraphic Principles and Practices, Weller, J.M, (1962), Harper & Bros, New York
5.	Wadia, D. N, Geology of India, McMillan India Delhi (1953)

Web Resources

1.	https://stratigraphy.org/
2.	https://www.sepm.org/
3.	https://www.geosocindia.org/
4.	https://www.moes.gov.in/
5.	https://isegindia.org/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	GEOSTATISTICS AND COMPUTER APPLICATIONS IN GEOLOGY	Elective	Y	-	-	-	3	5	25	75	100

Course Objectives	
CO1	Understand various statistical techniques
CO2	Know the important of Geological Data types
CO3	Know various Geological Data Analyses
CO4	Know the Computer capabilities
CO5	To predict the Windows 2013 and application

Unit	Details	No. of Hours	Course Objectives
I	Definition of Statistics - Sampling and population. Measures of central tendency –mean, median, mode, standard deviation, skewness and kurtosis. Nominal, Ordinal, Interval and Ratio scales. Discontinuous and continuous data. Ungrouped and grouped scores. Graphical representation of data; bar charts, histograms, line graph, XY graph, frequency and cumulative frequency curves. Hypothesis testing, x2 student's 't' and Snedecor's 'F' tests.	15	CO1
II	Geological Data types - Parametric Statistics and Nonparametric Statistics. Karl Pearson's correlation, Spearman's rank correlation - Probability and normal distribution - Simple Linear Regression - Goodness of fit tests: Chi-square test. Scales of measurements.	15	CO2
III	Geological Data Analyses - Principal component analysis – Discriminant analysis – Time series analyses - map analysis – Cluster analysis – Factor analysis.	15	CO3
IV	Computer capabilities – General structure of a computer – Hardware components. Input devices (keyboard and mouse) output devices (dot matrix printers and Inkjet Printers) and storage devices (Disk organization, Floppy Disks, Hard disks and Compact discs) Computer applications in geology – Structured programming, algorithm and flowchart.	15	CO4

V	Windows 2013:- Introduction – Graphical user interface objects:- windows, icons, menus, pointers. desktop features: - short cut, task Bar, start, time and status. MS – WORD 2000: Introduction – menu bar – tool bar – drawing tools bar – Document creation and formatting. MS – EXCEL 2013: Worksheet concept – menu Bar, tool Bar, building formulas. Data Analysis using MS – Excel 2013: Data file creation – calculation of summary statistics.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Appreciate various statistical techniques	PO1
CO2	Distinguish the important of Geological Data types	PO1, PO2
CO3	Know various Geological Data Analyses	PO4, PO6
CO4	Recognize the Computer capabilities	PO4, PO5, PO6
CO5	Identify the Windows 2013 and application	PO3, PO8

Text Books
(Latest Editions)

1. Krishna, N. 2001. Computer Fundamentals and windows with Internet Technology,
SCITECH, Tirunelveli.
2. Davies, J.C. 1973. Statistics and data analysis in Geology, Wiley.
3. Harbaugh, J.W. & Merriam, D.F.1965. Computer application in Stratigraphic analysis, Wiley.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Krumbein W.C. and Gray bill F.A. 1965. An introduction to statistical models in Geology, McGraw Hill
2. Miller R.L. Kahn, J.S. 1962. Statistical analysis in the Geological Sciences, Wiley.

Web Resources

1. https://link.springer.com/book/10.1007/978-1-4020-9380-7
2. https://www.amazon.in/Geostatistics-Applications-Earth-Sciences-Sarma/dp/1402093799

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	2	1	1	2	1	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Geophysics and Exploration Techniques	Elective	Y	-	-	-	3	5	25	75	100

Course Objectives	
CO1	Remember the fundamental concepts associated with gravity, magnetism, electricity and wave motion
CO2	Understand the principles of gravity, magnetic electrical and seismic methods
CO3	Apply the geophysical concepts in prospecting of economically important deposits.
CO4	Analyze the various groundwater bodies using geophysical methods
CO5	Evaluate geophysical character of rocks.

Unit	Details	No. of Hours	Course Objectives
I	Inter-relationship between geology and geophysics-Role of geological and geophysical data in exploration of earth resources. Parameters of Geophysical data in oil and gas Exploration, ore and groundwater exploration, application of geophysics in rock property studies.	15	CO1
II	Gravity methods - Basic principles of gravity – Types of Gravimeters – Gravity measurement techniques – Data correction methods – Interpretation Techniques	15	CO2
III	Magnetic methods – Magnetic properties of Rocks- Magnetometers -data collection – Interpretation – Applications of Magnetic methods	15	CO3
IV	Electrical Methods: Electrical properties of rocks, Flow of current through ground surface, Apparent resistivity, Electrode arrangements of Wenner and schlumberger methods. Vertical electrical sounding - Qualitative and quantitative interpretation of VES curves for groundwater exploration.	15	CO4
V	Seismic Methods: Basic principles, types of seismic waves and their propagation characters, Seismic velocities in Earth's materials. Refraction and reflection seismic methods: Basic principles, field procedure, data collection and interpretation.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.

Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Remember the fundamental concepts associated with gravity, magnetism, electricity and wave motion	PO1
CO2	Understand the principles of gravity, magnetic electrical and seismic methods	PO1, PO2
CO3	Apply the geophysical concepts in prospecting of economically important deposits.	PO4, PO6
CO4	Analyze the various groundwater bodies using geophysical methods	PO4, PO5, PO6
CO5	Evaluate geophysical character of rocks.	PO3, PO8

Text Books
(Latest Editions)

1.	Ramachandra Rao, M. B., Prasaranga, 1975. Outlines of Geophysical Prospecting–A manual for geologists by University of Mysore, Mysore.
2.	Bhimasarikaram V. L. S. 1990. Exploration Geophysics- An Outline by., Association of Exploration Geophysicists, Osmania University, Hyderabad.
3.	Dobrin, 1984. An Introduction to Geophysical Prospecting by, M. B. McGraw Hill, New Delhi.
4.	Telford W. M. Geldart L. P., Sheriff, R. E. and Keys D. A. 1976, Applied Geophysics. Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi,
5.	Parasnis, D. S 1975. Principles of applied Geophysics, Chapman and Hall.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Kearey, P Brooks (1991) An introduction to geophysical exploration, Blackwell
2.	Umeshwar Prasad, 1996, Economic geology, CBS Publishers and distributors, NewDelhi.
3.	Todd, D. K. (2008). Groundwater Hydrology. 5thed. Wiley. New Delhi.
4.	Davis, S. N. & R. J. M. DeWiest (1966). Hydrogeology.Wiley.Delhi.
5.	Edward R. and Atkinsan K. 1986. Ore deposit Geology, Chapmon and Hall,

Web Resources

1.	https://geologyscience.com/geology-branches/geophysical-methods/
2.	https://www.gsi.ie/en-ie/programmes-and-projects/minerals/activities/mineral-exploration/Pages/Geophysical-Methods.aspx
3.	https://www.science.gov/topicpages/g/geophysical+exploration+techniques
4.	https://www.ngri.res.in/#
5.	https://clu-in.org/characterization/technologies/default2.focus/sec/Geophysical_Methods/cat/Overview/

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	DISASTER MANAGEMENT	Elective	Y	-	-	-	3	5	25	75	100

Course Objectives	
CO1	Remember the fundamental concepts of disaster
CO2	Understand the principles of Natural Disasters
CO3	Apply the disaster concepts in Environmental Disasters
CO4	Analyze the various factors of climate change
CO5	Evaluate factors of Disaster Risk Management

Unit	Details	No. of Hours	Course Objectives
I	Introduction – Hazard and Disaster: Definition and Terminologies - Classification. Concept of Disaster management - Comprehensive Disaster Management Plan. Elements of Disaster Management Plan.	15	CO1
II	Natural Disasters - Earthquake, Landslide, Avalanches, Volcanic eruptions – Their case studies. Heat and Cold Waves, Coastal disasters, Coastal regulation Zone, Cyclone, Flood, Drought, Tsunami.	15	CO2
III	Environmental Disasters - Dam collapse and Mitigation measures. Nuclear disasters, Chemical Disasters, Biological Disasters, Forest fire and Oil fire.	15	CO3
IV	Climate change: global warming, sea level rise, ozone depletion, carbon sink and sources - causes and effects.	15	CO4
V	Disaster Risk Management; Institutional arrangement: Prevention, Preparedness, and Mitigation; Disaster Preparedness Plan. Application of Information Technology in Disaster Preparedness. Hazards and Vulnerability scenario in India; Disaster relief and its components – water, food, sanitation, shelter, health and waste management; Disaster Management Act and Policy.	15	CO5
	Total	**75**	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit.

There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Reminisce the fundamental concepts of disaster	PO1
CO2	Appreciate the principles of Natural Disasters	PO1, PO2
CO3	Apply the disaster concepts in Environmental Disasters	PO4, PO6
CO4	Investigate the various factors of climate change	PO4, PO5, PO6
CO5	Appraise factors of Disaster Risk Management	PO3, PO8

Text Books
(Latest Editions)

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
5.	and Local Solutions, Universities Press, Hyderabad, India.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Govt. of India (2009) National Disaster Management Policy.
2.	Gupta, A.K. and Nair, S.S. (2011) Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi.
3.	Murthy, R.K. (2012) Disaster management, Wisdom Press, New Delhi

Web Resources

1.	https://www.scientificpubonline.com/bookdetail/text-book-disaster-management/9789389412451/0
2.	https://www.satishserial.com/book/9789381226704/textbook-of-disaster-management

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Extension Activity- Geological long field studies			-	-	-	1		50	50	100

Course Objectives	
CO1	Students to know the various structural features, rock formation, stratigraphy, economic minerals and mines activity.

Unit	Details	No. of Days	Course Objectives
I	Students will be taken to various rock formation, mines and mineral exploration industries, Palaeontological visit and collection of samples within south India to gain first hand field experience in the field of Geology, interaction with subject experts in various industries and organizations involved in research and mineral exploration activities.	Max. 14	CO1
	Total		

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular Unit. There will be equal number of Course objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Students to understand the structural features and various rock formation, how the fossils are formed and extinct and mining activity.	PO1

Text Books

(Latest Editions)		
1.		
2.		
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.		
2.		
Web Resources		
1.		
2.		
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	50
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	50
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.
The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1								
CO 2								
CO 3								
CO 4								
CO 5								

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	GEOHAZARDS	Naan Mudhalvan		-	-	-	2			100	100

Course Objectives	
CO1	Remember the Geological Hazards
CO2	Understand the Geological events
CO3	Apply the concepts of Landslides
CO4	Analyze the Oceans and atmosphere
CO5	Evaluate the different coastal zones and events

Unit	Details	No. of Hours	Course Objectives
I	Geological Hazards: Introduction to Natural Hazards. Earthquakes: Causes and Measurements – Earthquake Hazards and Risks – Earthquake Prediction and Control – Earthquake Case Histories – Tsunami.		
II	Volcanoes, Magma, and Volcanic Eruptions- Volcanic Landforms, Volcanoes and Plate Tectonics – Volcanic Hazards, Beneficial Aspects, and Predicting Eruptions- Volcanic Case Histories.		CO2
III	Landslides – Mass Wasting and Mass – Wasting Processes – Slope Stability, Triggering Events, Mass Wasting Hazards – Subsidence: Dissolution & Human Related Causes.		CO3
IV	The Ocean-Atmosphere System – Thunderstorms & Tornadoes – Tropical Cyclones – Hurricane – Tornadoes – Windstorms – Lightening – Drought – Frost and Freezes – Wildfire.		CO4
V	Coastal Zones – Coastal Erosion – River Systems & Causes of Flooding –River Flooding – Flooding Hazards, Prediction and Human Intervention. Extra-terrestrial Hazards. Meteorites & Impacting Events.		CO5
	Total		

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Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Reminisce the Geological Hazards	PO1, PO2
CO2	Realize the Geological events	PO1, PO2
CO3	Apply the concepts of Landslides	PO4, PO6
CO4	Investigate the Oceans and atmosphere	PO4, PO5, PO6
CO5	Gage the different coastal zones and events	PO3, PO8
Text Books (Latest Editions)		
1.	Montgomery, C.W. (2008), Environmental Geology, McGraw Hill 8thEdition.	
2.	Abbott Patrick, L. (2006), Natural Disasters, McGraw Hill, Boston, M	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Bryant, E. (2005), Natural Hazards, Cambridge University Press, Cambridge, U.K	
Web Resources		
1.	https://link.springer.com/book/10.1007/978-3-031-24541-1	
2.	https://www.gfdrr.org/sites/default/files/publication/road-geohazard-risk-management-handbook.pdf	
3.	https://archive.org/details/geohazardsnatura0000unse	

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The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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

S-Strong (3), M-Medium (2), L-Low (1)