



RANI CHANNAMMA UNIVERSITY

BELAGAVI

THE COURSE STRUCTURE & SYLLABUS OF UNDER GRADUATE

BACHELOR OF SCIENCE

GEOLOGY

1ST TO 6TH Semesters

w.e.f.

**Academic Year 2020-21 and Onwards
Under**

CHOICE BASED CREDIT SYSTEM (CBCS)

CHOICE BASED CREDIT SYSTEM [CBCS] B.Sc. Program with Geology Optional Subject

B.Sc.: Geology as one of the optional subject revised syllabus under CBCS (w.e.f. 2020-21 and onwards)								
Sem	Part	Paper Code	Title of Paper	Hours/Week	Marks			Subject Credits
					IA	Exam	Total	
I	Part – 1 DSC	GEODSCT 1.1	Dynamic Geology, Geomorphology & Field Geology	4	20	80	100	3
		GEODSCP 1.1	Practicals-I	3	10	40	50	1
	Total : Hours / Credits				7			150
II	Part – 1 DSC	GEODSCT 2.1	Optical Mineralogy Crystallography & Mineralogy	4	20	80	100	3
		GEODSCP 2.1	Practicals-II	3	10	40	50	1
	Total : Hours / Credits				7			150

B.Sc.: Statistics as one of the optional subject revised syllabus under CBCS (w.e.f. 2021-22 and onwards)								
Sem	Part	Paper Code	Title of Paper	Hours/Week	Marks			Subject Credits
					IA	Exam	Total	
III	Part – 1 DSC	GEODSCT3.1	Petrology: Igneous Sedimentary & Metamorphic	4	20	80	100	3
		GEODSCP 3.1	Practicals-III	3	10	40	50	1
	Part – 2 SEC	GEOSECT 3.2	Energy Resources	2	10	40	50	2
	Total : Hours / Credits				9			200
IV	Part – 1 DSC	GEODSCT 4.1	Palaeontology, Principles of Stratigraphy & Indian Stratigraphy	4	20	80	100	3
		GEODSCP 4.1	Practicals-IV	3	10	40	50	1
	Part – 2 SEC	GEOSECT 4.2	Fundamentals of Remote Sensing	2	10	40	50	2
	Total : Hours / Credits				9			200

CHOICE BASED CREDIT SYSTEM [CBCS]

B.Sc.: Geology as one of the optional subject revised syllabus under CBCS (w.e.f. 2022-23 and onwards)								
Sem	Part	Paper Code	Title of Paper	Hours/Week	Marks			Subject Credits
					IA	Exam	Total	
V	Part – 1 DSE	GEODSET 5.1	Structural Geology and Surveying	4	20	80	100	3
		GEODSEP 5.1	Practicals-V	3	10	40	50	1
		GEODSET 5.2A (Elective-I)	Ore Processes, Indian Mineral Deposits and Exploration Geology	4	20	80	100	3
		GEODSEP 5.2A (Elective-I)	Practicals	3	10	40	50	1
		GEODSET5.2B (Elective-II)	Marine Geology	4	20	80	100	3
		GEODSEP 5.2B (Elective-II)	Practicals	3	10	40	50	1
	Part – 2 SEC	GEOSECT 5.3	Gemology	2	10	40	50	2
		Total : Hours / Credits			16			350
Note: Students have to choose either Elective-I or Elective-II								
VI	Part – 1 DSE	GEODSET 6.1	Hydrogeology & Geochemistry	4	20	80	100	3
		GEODSEP 6.1	Practicals	3	10	40	50	1
		GEODSET 6.2A (Elective-III)	Remote Sensing & GIS	4	20	80	100	3
		GEODSEP 6.2A (Elective-III)	Practicals	3	10	40	50	1
		GEODSET6.2B (Elective-IV)	Environmental Geology & Engineering Geology	4	20	80	100	3
		GEODSEP 6.2B (Elective-IV)	Practicals	3	10	40	50	1
	Part – 2 SEC	GEOSECT 6.3	Mining Geology	2	10	40	50	2
		Total : Hours / Credits			17			350
Note: Students have to choose either Elective-III or Elective-IV								

B.Sc. Program with Geology Optional Subject

(T: Theory, P: Practical, CC/EA: Co-curricular/Extension Activities

AECC: Ability Enhancement Compulsory Course, DSC: Discipline Specific Course

DSE: Discipline Specific Elective, SEC: Skill Enhancement Course)

Note: Duration of examinations is 03 Hrs for 80 Marks theory and 02 hrs for 40 marks theory. For practical's duration of examination is 03 Hrs.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

Department of Geology

B.Sc Semester wise Geology Course Scheme under
Choice Based Credit System (CBCS) with Effect from 2020-21 onwards

The Geology Department of SKE Society's Govindram Seksaria Science (GSS) College seeks to provide the basic and fundamental concepts in Geology through our educational, research, and outreach programs, in order to produce well-trained, young geoscientists capable of responding to societal needs.

The Department's Mission

The Geology Department will develop in each student, art of imagination, critical thinking, and enthusiasm; build necessary skills to be a good geoscientist and to be the lifelong lover of mother earth.

To facilitate integrated and interdisciplinary approach in their learning.

Develop a greater awareness of Earth Sciences in the general public through outreach programs.

Objectives

The basic objective is to establish the Department of Geology of GSS College as the centre for research in this part of the country and Promoting the development of Geology.

The Geology department also strives to develop in each student the concern towards sustainable use of natural resources such as- minerals, water and energy sources. Other important objectives are -

To impart and inculcate the basic geological knowledge to students and prepare them to be a good geoscientist.

To imbibe in them the love towards mother earth and care for the environment.

To create awareness in them about the Earth's environment, critical issues and need for sustainable development.

To produce well-trained, budding geoscientists capable of responding to societal needs.

To achieve the knowledge and skills in Geology and to experience the multidisciplinary approach.

To develop abilities of logical thinking and imagination; importance of field data collection, data analysing, synthesizing and drawing fair conclusions.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

Department of Geology

B.Sc Semester wise Geology Course Scheme under
Choice Based Credit System (CBCS) with Effect from 2020-21 onwards

Note:

- a) In Vth semester the students have one compulsory Theory paper (**DSE-VE**) and Practical (**DSE-VE(P)**); whereas one theory of the two **DSE-VE¹** OR **DSE-VE²** and corresponding practical **DSE-VE(P¹)** OR **DSE-VE(P²)** need to be chosen. Similarly in VIth semester the students have one compulsory Theory paper (**DSE-VIF**) and Practical (**DSE-VIF (P)**); whereas one theory of the two **DSE-VIF¹** OR **DSE-VIF²** and corresponding practical **DSE-VIF(P¹)** OR **DSE-VIF(P²)** need to be chosen.
- b) **Student batch:** As this is a semi technical and at present available only at GSS College, each batch should consist of not more than 15 students for the regular practical classes.
- c) **Practical Record:** Submission of a well-maintained Journal of the Practical Work done during the semester is necessary before the Practical Examination.
- d) **Assignments:** The students will be given assignments, which are to be submitted before the 2nd Internal Test examination.
- e) **Geological Field Report:** As the geological features, structures, rock and mineral occurrence are better understood in the field, there will be a Geological Study Tour to the places of geological interest for 3- 10 days, mainly to study the field occurrence of geological features, rocks and minerals etc., during each semester, which carries weightage during semester end exam. Each student shall submit a consolidated study tour report along with the journal.

NATURE OF THEORY AND PRACTICAL EXAMINATION

a) Theory Examination: (Total 100 Marks)

- i) There will be one theory paper of 80 marks in each semester.

Each paper will contain THREE Sections, which are to be written in the same answer book.

PART A: TWELVE Questions (Definitions/two sentence answers) numbered 1-12, each of 2 marks. Students need to answer ANY TEN questions. (2x10 = 20 Marks)

PART B: SIX Questions (Short answers) numbered as 13,14,15,16,17 & 18. Each of FIVE marks students need to answer ANY FOUR questions (4x5 = 20 Marks)

PART C: FIVE Questions (Descriptive answers) numbered 19,20,21,22 & 23. Each of TEN marks, students need to answer ANY FOUR questions (4x10 = 40 Marks)

- ii) **The remaining 20 marks** are allotted for Internal Assessment Marks – of 1 hour 15 minutes **for two internal tests** in theory.

- a. Two internal tests of 20 marks each reduced to 10 marks.
- b. Internal Assignment/Seminars/Student project work/Viva-voce (10 marks): Students are given assignments/seminars on the subject taught or a student project work.

b) Practical Examination: Total 50 Marks.

- a. Practical examination will have 3 or 4 Questions of **30 marks**.
- b. Practical Record (Journal), Field study tour report and Viva Voce carry (**10 marks**).
- c. Practical Internal test: One internal test of 20 marks reduced to 10. (**10 marks**).

B.Sc I Semester Geology Theory

GEODSCT 1.1 Dynamic Geology, Geomorphology & Field Geology - (Credits -3)

Total 60 Lectures

Course Objectives

Earth science which deals with basic concepts of natural internal forces and external forces which shape the earth surface. The course deals with hypotheses of origin of earth, age of earth; geomorphological features resulting from the action of geological agents on the earth surface. Also, helps in understanding the processes in action on the earth's surface and their impact on man and his property.

Learning Outcomes

The study strengthens the students' knowledge in understanding the essentials of the earth's dynamics, involving the dynamic forces such as – river, wind, glacier, sea, temperature variation etc.

UNIT	TOPICS	Lectures
	A. DYNAMIC GEOLOGY	
I	Introduction: Definition of Geology, branches of geology, role of geology in the development of mankind.	12
	Origin and Age of Earth: Nebular– Planetesimal hypotheses; Big bang theory, cooling and consolidation of earth. Age of Earth (from history of organic evolution, sedimentation, salinity of sea water, rate of cooling & radioactive dating).	
	Interior of Earth: Interpretation of interior of earth using seismic waves, Discontinuities (Concade, Mohorovicic, Repetti, Gutenberg and Lehman discontinuities). General description of Crust, Mantle and Core.	
	Geological Agents: Epigene and Hypogene agents. Epigene agents: atmospheric- heat, gases, moisture, surface-subsurface water, sea water, wind and ice. Hypogene agents: Internal heat, Magmatic emanations, magma.	
	Isostasy: Pratt's and Ary's hypotheses. Seafloor Spreading, Continental Drift Theory and Plate Tectonics: Wegener's Theory of Continental Drift. Mid Oceanic Ridges, Convection currents, Constructive and Destructive plate boundaries (Divergent, Convergent and Transform)	
II	Volcano: Definition – typical volcano. Classification of volcanoes: active, dormant and extinct. Types of eruptions: fissure and central eruptions. Products of volcano: liquid (lava), solid (cinder, lapilli, volcanic bombs, áá, ash) and Gases. Effects of volcano.	12
	Earthquake: Definition – focus and epicenter. Seismic waves: body (P & S) and surface waves (Love & Rayleigh); Causes- non tectonic (volcanic, landslides, explosions) and tectonic: elastic rebound theory; classification based on depth of epicenter; intensity: Mercali and Richter scale; seismograph and seismogram; seismic belt of India; effects of earth quake & tsunami; and prediction of earthquakes.	

B. GEOMORPHOLOGY		
III	<p>Basic concepts of Geomorphology.</p> <p>Weathering: Definition, agents of weathering- Physical, Chemical and Biological. Physical weathering: frost action (wedging and heaving); thermal weathering- spheroidal weathering (exfoliation); action of gravity - scree, talus, Chemical weathering: Water as a chemical agent. Oxidation, hydration and carbonation. Biological weathering: Action of plants, animals and man. Products of weathering-formation and types of soil.</p>	12
	<p>Wind : Geological action of wind- erosion, transportation and deposition</p> <p>Erosion and Erosional features- deflation- winnowing action, oasis, playas. Abrasion- ventifact, pedestal rocks, yardang, pinnacles/ inselberg. Attrition- millet seed sand.</p> <p>Transportation- Suspension, saltation, traction/rolling.</p> <p>Deposition and depositional features: sand dunes- longitudinal, transverse dunes, barchans and loess deposit.</p>	
	<p>Coastal Processes: Definition of Coast. Types of Coasts. Shoreline of Emergence & Subsidence. Waves and Tides. Geological work of Sea waves – Erosion, Transportation and Deposition. Coastal landforms - Island, Beach, Estuary, Bay, Cliffs, Longshore Bar, Spit, Barrier and Fore dunes.</p>	
IV	<p>River: Origin of River. Stages of River: Initial stage, Youth stage - water fall, cascade, and river capture/piracy; Valley -V-shape valley, vertical cutting; canyon/gorge; pot hole; Mature stage- lateral cutting, meandering, oxbow lake, natural levee, flood plain, alluvial fan; and Old stage- base level of erosion, and delta. Geological action of River- erosion: hydraulic action- abrasion, attrition, corrosion;</p> <p>Transportation: solution, suspension, saltation and rolling. Formation of river terraces and their types.</p>	12
	<p>Glacier: Definition, snow field, snow line, neve/fern.</p> <p>Movement of glaciers, types of glaciers – valley glacier, piedmont glacier, ice sheet. Surface features: Crevasses, types of crevasses – bergshrund, longitudinal, transverse and marginal. Geological action of Glacier: erosion – abrasion, excavation/valley plucking, frost wedging and scraping; Erosional features- cirque/corrie, arête, horns, U-shape valley, hanging valley, rochesmoutonnee. Deposition – depositional features: moraines- lateral, medial, terminal/end, ground moraines, tillite, erratic/perched block. Glacio-fluvial deposits- Outwash plain, kettle hole, kames, drumlins, eskers.</p>	
V	C. FIELD GEOLOGY	12
	<p>Geological Equipments: Brief introduction to - Toposheet, Hammer, Hand lens, Clinometer and Brunton Compass. Global Positioning System.</p> <p>Geological Field Report: Aims and Objectives, Introduction, Study Area, Accessibility, Climate, Geology of the area, Methodology, Results, Discussions, Conclusion, Bibliography and Appendix.</p>	

B.Sc I Semester Geology Practical

GEODSCP 1.A

Interpretation of Topomaps, Geomorphological Models & Morphometric analysis (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. Interpretation of topographical maps; latitude-longitude, conventions, relief, drainage, settlement, transportation and communication.
2. Describe the following geomorphological models with neat sketches and labeling: Stages of river- Initial, Youth, Mature and Old stage; Typical Volcano; Karst topography; Glacial landforms; Coastal landforms.
3. Morphometric analysis of a river basin.
4. **Demonstration:** Taking bearings with the help of Brunton compass, Clinometer to find out dip and strike of the beds (attitude of beds). Taking bearing with Global Positioning System (GPS).

BOOKS RECOMMENDED

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|---------------------------------------|--------------------------|
| 1. Principles of Physical Geology | A. Holmes |
| 2. Geomorphology | V.K. Sharma |
| 3. Aspects of tectonics | K.S. Valdiya |
| 4. Environmental Geology | K.S. Valdiya |
| 5. General Geology | Radhakrishanan. V |
| 6. A text book of Geology | Mahapatra, G.B |
| 7. Text book of Geology | P.K.Mukherjee |
| 8. Text book of Geology | A.K.Datta |
| 9. Engineering Geology | Parbin Singh |
| 10. Principles of Engineering Geology | K.M.Bangar |
| 11. Introduction to Geomorphology | V.S. Kale & Avijit Gupta |
| 12. Field Geology | F.H.Lahee |

B.Sc II Semester Geology Theory
GEODSCT 2.1 Optical Mineralogy, Crystallography & Mineralogy - (Credits -3)

Total 60 Lectures

Course Objectives

The course deals with the study of minerals, their chemistry and identification in hand specimen. Further, it also deals with the study of crystals w.r.t their morphology, symmetry and the normal crystal classes.

Learning Outcomes

Studying the basics of mineralogy and crystallography helps in understanding and building the overall knowledge in Geology.

UNIT	TOPIC	Hrs
	A. MINERALOGY	
I	Definition of mineral. Properties depending upon light - color, streak, diaphaneity, luster. Properties depending upon state of aggregation - Forms- columnar, lamellar and granular. Imitative shapes - reniform, botryoidal, mamillary, amygdaloidal, vesicular, dendritic, stalactitic and stalagmitic.	12
	Forms - Isomorphism, polymorphism, pseudomorphism Properties depending upon cohesion and elasticity - Cleavage, Fracture, Hardness (Moh's scale of hardness) and Tenacity; Other properties : Taste, Odor, Feel, Magnetism, Electricity. Specific Gravity – Walker Steel Yard Balance.	12
II	Silicate Mineral Structures. General characters and uses of following group of minerals : Quartz, Felspar, Mica, Pyroxene, Amphibole, Olivine & Garnet	12
	B. OPTICAL MINERALOGY	
III	Nature of light – Electromagnetic wave. Ordinary and polarized light – Reflection, refraction and refractive index, critical angle and total internal reflection. Double refraction. Petrological microscope : Introduction to parts of microscope. Preparation of thin section. Polarization : polarization by reflection, Brewster's law - polarization by refraction, polarization by absorption.	12
IV	Construction of Nicol Prism – Behavior of light in the microscope without mineral, with isotropic mineral and with anisotropic mineral. Optical Accessories : Mica plate, Gypsum Plate and Quartz Wedge. Optical properties of mineral : in plane polarised light- colour, pleochroism, form, cleavage, fracture, relief. Properties in analysed light/crossed nicols - Isotropism and anisotropism; Interference Colours; Birefringence; Extinction - types, extinction angle; Zoning and Twinning.	12

C. CRYSTALLOGRAPHY		
V	Definition of crystal, morphological characters of crystal – face, form, edge, solid angles, Euler’s law. Interfacial angle, Contact Goniometer and its use. Symmetry characters– Plane, axes and centre. Crystallographic axes, axial ratio and notation. Parameters- Weiss parameter, Miller indices. Study of crystal forms of normal classes of all six crystal systems- 1) Isometric, 2) Tetragonal, 3) Trigonal, 4) Hexagonal, 5) Orthorhombic, 6) Monoclinic and 7) Triclinic.	12

B.Sc II Semester Geology Practical

GEODSCP 2.1 MINERALOGY, OPTICAL MINERALOGY & CRYSTALLOGRAPHY (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 lectures

1. **Mineralogy:** Study of general characters and uses of following minerals.
 Quartz- Rock Crystal, Amethyst, Chalcedony, Agate, Flint, Jasper, Opal. Felspars- Orthoclase, Microcline, Plagioclase; Zeolites- Natrolite, Stilbite; Mica- Biotite, Muscovite, Pyroxene- Hypersthene, Augite, Diopside; Amphibole- Hornblende, Olivine, Garnet; Calcite, Dolomite, Magnesite, Kyanite, Corundum, Beryl, Tourmaline, Talc, Serpentine, Asbestos & Barites.
2. Determination of specific gravity by Walker steel yard balance.
3. **Optical Mineralogy:** Optical properties (under plane polarized and analysed light) of following minerals- Quartz, Orthoclase, Microcline, Plagioclase, Muscovite, Biotite, Hypersthene, Augite, Hornblende, Olivine, Kyanite, Calcite, Garnet, Magnetite & Hematite.
4. Determination of Extinction and Cleavage angle under microscope.
5. **Crystallography:** Forms of a crystal: face, edge, solid angle, Euler’s law, Interfacial angle with the help of Contact Goniometer. Study of elements of symmetry of crystal models of normal classes of six crystal systems: Isometric/Cubic, Tetragonal, Orthorhombic, Hexagonal, Monoclinic, Triclinic systems.

BOOKS RECOMMENDED

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|--|----------------|
| 1. Rutley's Elements of Mineralogy | H.H. Read |
| 2. Optical Mineralogy | Kerr.P.F |
| 3. Optical Mineralogy | Winchel |
| 4. Mineralogy for students | M.I. Batty |
| 5. Mineralogy | Berry & Mason |
| 6. Dana's Text book of Mineralogy | W.E. Ford |
| 7. Optical Mineralogy | E.E. Wahlstrom |
| 8. Elements of Optical Mineralogy | A.N. Winchell |
| 9. Engineering Geology | Parbin Singh |
| 10. Principles of Engineering Geology | K.M.Bangar |
| 11. Treatise of Minerals of India | R.K.Sinha |
| 12. An introduction to crystallography | Phillips, P.C |

B.Sc III Semester Geology

GEODSCT 3.1 Petrology: Igneous, Sedimentary & Metamorphic (Credits -3)

Total 60 Lectures

Course Objectives

Petrology is the science of rocks. The course will help the students to exhibit an improved understanding of fundamental petrologic processes and common rock types and their occurrences. In practical's, students learn to identify, describe and classify rocks using hand specimens and under microscope.

Learning Outcomes

On completion of the course the students:

- (i) Will have gained an identification and understanding of the processes involved in the formation of a rock, their textures, structures, classifications and their importance.
- (ii) Will have learned to differentiate between the different rock types based on their physical and petrographic properties.

UNIT	TOPIC	Hrs
I	Introduction- Classification of rocks into igneous, sedimentary and metamorphic. Rock cycle.	12
	Igneous Petrology: Magma- Definition, composition- acidic and basic magma. Mode of occurrence of igneous rocks: Intrusive and extrusive igneous rocks. Crystallisation of magma – Unicomponent and Bicomponent system.	
	Forms of Igneous rocks- Concordant – sill and lacolith; Discordant – dyke and batholith. Structures of Igneous rocks – Vesicular, Amygdaloidal, Flow, Pillow, Ropy and Columnar.	
II	Textures in igneous rocks: Definition. Crystallinity, granularity, shape of the crystal, mutual relationship. Equigranular texture: Panidiomorphic, hypidiomorphic, allotriomorphic; Inequigranular texture: Porphyritic, poikilitic, ophitic/subophitic, basaltic (intersertal-intergranular); Intergrowth texture: graphic, Directive structure: Flow/trachytic.	12
	Classification of Igneous rocks: Chemical classification- CIPW, Shand and Holmes, based on silica content (acidic, basic, intermediate and ultrabasic). Mineralogical classification- color index (leucocratic/felsic and melenocratic/mafic); Mineral content in rock: essential, accessory and secondary minerals.	
III	Sedimentary Petrology: Introduction: Weathering, transportation, deposition, lithification and diagenesis.	12
	Structures of sedimentary rocks: stratification, lamination, graded bedding, cross/ current bedding, ripple marks, mud cracks/sun cracks, rain prints and oolitic. Textures of sedimentary rocks: Clastic and non clastic. Wentworth grain size classification. Sphericity and roundness.	

	Classification of sedimentary rocks: Based on origin: Clastic/mechanical deposits and Non clastic deposits - residual, evaporites and non-evaporates/chemical and organic deposits; based on grain size- Rudaceous, arenaceous and argillaceous.	
IV	Metamorphic Petrology: Introduction: Agents of metamorphism- Temperature, pressure and chemically active fluids. Stress and anti-stress minerals. Metamorphic grades and zones, Phase rule, Facies concept. ACF & AKF diagrams.	12
V	Types of metamorphism with brief descriptions: Cataclastic, thermal, dynamothermal, plutonic metamorphism, and their effects on arenaceous, argillaceous and basic rocks.	12
	Textures and Structures in Metamorphic rocks: Crystalloblastic, Palimpsest. Cataclastic, Granulose, Gneissose & Schistose.	

B.Sc III Semester Geology Practical

GEODSCP 3.1 PETROLOGY (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. **Megascopic Structures:** (i) **Igneous rocks:** vesicular, amygdaloidal, columnar, pillow. (ii) **Sedimentary-** Stratification, lamination, graded bedding, cross/current bedding, ripple, mud cracks, oolitic. (iii) **Metamorphic-** Granulose, schistose, gneissose and slaty cleavage.
2. **Megascopic study of Rocks:** i) **Igneous:** Granite, Syenite, Diorite and their porphyry; Pegmatite; Dolerite, Basalt; Dunite; Obsidian, Pumice. (ii) **Sedimentary:** Breccia, Conglomerate, Sandstone, Limestone, Shell/fossiliferous limestone. iii) **Metamorphic:** Slate, Marble, Schist (Mica, Garnet), Quartzite, Gneiss (Banded & Augen).
3. **Study of Textures in thin section:** i) **Igneous:** Equigranular- Panidiomorphic, Hypidiomorphic, Allotriomorphic; Inequigranular- Porphyritic, Poikilitic, Ophitic/Subophitic, Basaltic (Intergranular/Intersertal), Graphic.
ii) **Sedimentary:** Clastic, Non Clastic, Oolitic
iii) **Metamorphic:** Granulose, Schistose, Gneissose
4. **Study of Rocks in thin section:** i) **Igneous:** Granite, Syenite, Diorite and their porphyry; Pegmatite; Dolerite, Basalt; Dunite.
(ii) **Sedimentary:** Breccia, Conglomerate, Sandstone, Limestone, Shell/fossiliferous limestone
iii) **Metamorphic:** Marble, Schist (Mica, Garnet, Chlorite), Quartzite, Gneiss (Banded and Augen).

TEXT BOOKS

1. Principles of Petrology - By G. W. Tyrrell, B.I.Publications Pvt. Ltd. Mumbai.
2. Igneous and Metamorphic Petrology - By Turner and Verhoogen
3. Igneous and Metamorphic Petrology - By Best M.G., CBS Publishers, Delhi
4. Igneous Petrology - By Mihir K. Bose
5. Igneous Petrology - By Anthony Hall
6. Metamorphic Petrology - By Turner, CBS Publishers, Delhi
7. Petrogenesis of Metamorphic Rocks - By Winkler H.G.F., Springer Verlag./ Narosa Publishing House, New Delhi.
8. Petrology of Metamorphic Rocks - By Mason Roger, CBS Publishers, Delhi
9. Sedimentary Rocks - By Pettijohn, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

10. Introduction to Sedimentology - By Sengupta, S
11. Petrology - By Ehlers and Blatt, CBS Publishers, Delhi.
12. Petrography - Williams, Turner, and Gilbert, CBS Publishers, Delhi.
13. Sedimentary Petrology : an Introduction to the Origin Sedimentary Rocks by M.E.Tucker
14. Principles of Sedimentology & Stratigraphy by S.J.Boggs (2006) Pettijohn.
15. Practical Approach to Sedimentology by Roy Lindholm (1987)
16. Origin of Sedimentary Rocks by Blatt, H. Middleton, G.V., & Murry, R.C.

B.Sc III Semester Geology

GEOSECT 3.2 Energy Resources (Credits -2)

25 Lectures

UNIT	TOPIC	Hrs
I	Introduction: Renewable and non renewable Energy Resources. Crisis providing current Indian Scenario.	5
II	Origin of Coal, types of coal, uses and its distribution in India.	5
III	Origin of Petroleum, Migration, accumulation, Structural traps, uses and its distribution in India.	5
IV	Nuclear energy Resources, Radioactive minerals – Beach placers viz., Zircon, Monazite, Rutile, Ilmenite	5
V	Alternative energy resources: Suns radiation, Hydro-electricity, Nuclear Energy, Near surface wind energy, Geothermal source, Oceanic gas hydrates “Clathrates”, Tidal energy and Biomass	5

TEXT BOOKS

1. Economic Mineral Deposits - Bateman Allan .M.
2. Economic Geology – Charles Richardson
3. Mineral Deposits - Lindgren W
4. Introduction to Ore-Forming Processes – Lawrence Robb
5. Ore Geology and Industrial Minerals – Anthony M Evans
6. Ore Deposits of India - G.K.Gokhale & Rao T.C.
7. Indian Mineral Resources - S.Krishnaswamy
8. Minerals of Karnataka - B.P.Radhakrishna
9. Treatise of Minerals of India - R.K.Sinha

B.Sc IV Semester Geology Theory

GEODSCT 4.1 Paleontology, Principles of Stratigraphy & Indian Stratigraphy (Credits -3)

Total 60 Lectures

Course Objectives

Stratigraphy and Paleontology, the two branches of Geology work together to unearth the history and evolution of the earth and its life. Stratigraphers study the composition and arrangement of layered or stratified rocks. Paleontologists study the remains of plants and animals which have been preserved in the earth's crust by natural processes. With these objectives in mind it becomes pertinent to understand the basic concepts of Stratigraphy and Palaeontology.

Learning Outcomes

The study of stratigraphy and Paleontology encompasses the aspects of the age of the earth, chronological arrangement of rocks and appearance and evolution of life through the geologic time. The knowledge of the concepts in stratigraphy, correlation, and paleontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations and also, in understanding the framework of the stratigraphy of India.

UNIT	TOPIC	Hrs
	PALEONTOLOGY	
I	Introduction: Fossil Definition, Mode of fossilisation- mummification, permineralisation, petrification, carbonisation, mould and cast, imprints, tracks and trails. Significance of fossils. Origin of life on Earth. Systematic classification of organisms.	12
	General morphological characters, description, and geological distribution of following phyla in brief: i. Phylum Protozoa - Foraminifera. ii. Phylum Ceolenterata - class Anthozoa, typical coral; class Graptolitoidea – Monograptus and Diplograptus.	
II	General morphological characters, description, and geological distribution of following phyla in brief: iii. Phylum Brachiopoda - Types of hinge line and distinguishing characters. iv. Phylum Echinoderma - Regularia and Irregularia	12
	General morphological characters, description, and geological distribution of following phylum in brief: v. Phylum Mollusca : class Lamellibranchs; class Gastropoda; class Cephalopoda- Nautiloidea and Ammonoidea- types of suture lines (simple, Goniatic, Ceratic and Ammonitic) vi. Phylum Arthropoda : class crustacea- Trilobites	
	PRINCIPLES OF STRATIGRAPHY	
III	Introduction: Definition, Uniformitarianism, Catastrophism, Order of superposition.	12
	Correlation and correlation methods - Petrological and paleontological.	
	Geological Time Scale: Important Geological events (climate, life and mountain building) in brief during- Paleozoic, Mesozoic and Cenozoic era.	

INDIAN STRATIGRAPHY		
IV	Brief account of physiographic divisions of India- Peninsular, extra peninsular and indo-gangetic alluvial plains.	12
	Petrology, classification and economic importance of- Archaeans of Karnataka.	
	Cuddappah system of Andhra Pradesh and its equivalents in Karnataka- Kaladgi series	
V	Petrology, classification and economic importance of- Vindhyan system.	12
	Petrology, classification and economic importance of- Gondwana system with flora and fauna	
	Petrology, classification and economic importance of- Deccan traps- Inter trappeans, infra trappeans, bagh and lameta beds. Petrology, classification and economic importance of- Cretaceous of Trichinopoly and Siwalik Group.	

B.Sc IV Semester Geology PRACTICAL

GEODSCP 4.1 PALEONTOLOGY & INDIAN STRATIGRAPHY (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. Sketch, label and describe with range in time of the following fossils.
 - i) **Phylum Protozoa:** Nummulites, Textularia
 - ii) **Phylum Coelenterata-** Monograptus-Diplograptus; Corals- Calceola, Zaphrentis, Montlivaltia.
 - iii) **Phylum Echinoderma:** Cidaris and Micraster
 - iv) **Phylum Brachiopoda:** Productus, Spirifer, Rhynchonella, Terebratula.
 - v) **Phylum Mollusca:** Class Lamellibranchia- Arca, Pecten, Gryphea; Class Gastropoda- Natica, Turitella, Turbo, Cypraea, Murex, Conus, Voluta, Fusus, Physa. Class Cephalopoda- Nautilus, Goniatite, Ceratite, Ammonite, Belemnites.
 - vi) **Phylum Arthropoda:** Paradoxides, Calymene, Trinucleus.
 - vii) **Plant Fossils:** General descriptions of plant fossils- Glossopteris, Gangamopteris; Ptillophyllum, Calamites, Lepidodendron and Sigillaria.

Plotting of following important geological systems/formations in the given map of India:

- i. Physiographic divisions – Peninsula, Extra peninsula, Indo-gangetic alluvial plain.
- ii. Cuddappah
- iii. Deccan Volcanic Province
- iv. Kaladgi
- v. Vindhyan
- vi. Gondwana
- vii. Cretaceous of Trichinopoly
- viii. Siwalik

TEXT BOOKS

1. Invertebrate paleontology - Henry woods
2. An introduction to Palaeobotany- Arnold, C.A.,
4. Principles of Paleontology, - Raup, D.M. and Stanley, M.S
5. Invertebrate Fossils -Moore , R.C., Laliker , C.G
6. Geology of India and Burma - Krishnan M.S
7. Geology of India - Wadia D.N
8. Stratigraphy of India- Ravindrakumar K.R.
9. Principles of Stratigraphy - Lemon R.Y
10. A manual of the Geology India and Burma - Pascoe, E.H.
11. General Stratigraphy - J.W. and Barret B.H
12. Historical Geology – Dunbar
13. Geology of India – M Ramakrishnan & R Vaidynadhan,

B.Sc IV Semester Geology

GEOSECT 4.2

Fundamentals of Remote Sensing (Credits -2)

25 Lectures

UNIT	TOPIC	Hrs
I	Introduction. Fundamentals of Remote Sensing. Raster and Vector data, Electromagnetic spectrum- Visible & Infrared spectrum Brief history and types of Indian Remote Sensing Satellites. Applications Remote sensing.	5
II	Passive and active sensors; Image Resolution- spatial, spectral, radiometric and temporal.	5
III	Types of Images: Panchromatic image, True Color & False color composite. Thematic images General principles and uses of pocket and mirror stereoscopes.	5
IV	Parts of aerial photographs: Fiducial Marks Types of aerial photographs- vertical, inclined/oblique photographs	5
V	Elements of photo/image interpretation: Photo elements- color, tone, texture, pattern, shape, size, shadow and associated features.	5

TEXT BOOKS

1. Miller (1961): - - Photogeology
2. Sabbins (1985): - Remote Sensing- Principles and Applications
3. Ray (1969): - Aerial Photographs in Geological Interpretations
4. Drury (1987): - Image Interpretation in Geology
5. Moffitt and Mikhail (1980): - Photogrammetry
6. Lillesand and Kieffer (1987): - Remote Sensing and Image Interpretation
7. Pandey S.N. (1987) Principles and Application

B.Sc V Semester Geology Theory

GEODSET 5.1 Structural Geology and Surveying (Credits -3)

Total 60 Lectures

Course Objectives

The course is designed for the students to understand the genesis, geometry and mechanics of the various geological structures owing to earth's tectonic forces. The surveying aspects are helpful to understand the mechanism of application of surveying in engineering and construction of roads/highways, rail lines and other mega constructions.

Learning Outcomes

1. The student will gain knowledge of the processes of formation of the structures.
2. Understand the significance of the rock structures and their appearance in the field.
3. Understand the surveying techniques used in construction designs of major constructions such as dams, bridges, tunnels, rail tracks, roads and highways etc

UNIT	TOPIC	Hrs
I	A. STRUCTURAL GEOLOGY	12
	Introduction: Stress, Strain, Rock deformation (brittle, plastic & elastic). Attitude of beds, Brunton compass and its uses.	
	Outcrop: Definition, width and thickness, factors controlling the width of outcrop, Outlier and inliers.	
	Conformity and unconformity , types of unconformities- angular, disconformity, blended, non conformity, regional and local unconformity. Recognition of unconformity in the field.	
II	Joints: definition, classification- geometric: strike, dip, oblique and bedding joints. genetic – columnar, feather, extension and release, sheeting, rift and grain. Significance of joints.	12
	Folds: definition, parts of fold- limb, hinge, axis, axial plane and plunge. Types of folds- Symmetrical, asymmetrical, anticline, syncline, over turned, isoclinal, recumbent, chevron, drag, monoclinial fold. Recognition of folds in the field.	
III	Faults: definition, terminology- fault plane, hanging wall and foot wall, dip and hade, throw and heave. Nature of movement- translation and rotational, relative movements- Slip, strike slip, dip slip and net slip;	12
	Classification of Faults: Geometric – strike fault, dip fault, oblique fault; based on apparent movement – normal and reverse fault. Genetic- thrust, gravity, graben, step, ridge and trough faults. Recognition of faults in the field.	
IV	B. SURVEYING	12
	Introduction: Definition, objectives, uses, classification of survey, principles of surveying, introduction to map and map projection, scales and types of scale, error and types of error. Linear Measurement: Distance measurement devices: Chain, tape, GPS, Electronic Distance Measurement (EDM) etc., corrections Direction and Angular measurement: Prismatic Compass, uses, types, meridians, bearings, local attraction, declination. Theodolite: Types, Temporary adjustment, Measurements of horizontal and vertical Angles	

V	<p>Traverse Survey: Types of traverses, Theodolite traverse – Field wor.k, Latitude, departure, Coordinate system of traverse, Adjustment of close traverse, other uses of theodolite.</p> <p>Leveling & Contouring: Definitions, Types of levels, methods of leveling, R.L. computations, various types of leveling, contour, characteristics, methods of plotting contour.</p>	12
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B.Sc V Semester Geology Practicals

GEODSEP 5.1 STRUCTURAL GEOLOGY & SURVEYING (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. Drawing of sections and writing the descriptions of the geological maps as given below (A minimum of 2 maps in each type).
 - i) Contour maps
 - ii) Horizontal strata with and without intrusions.
 - iii) Inclined strata with and without intrusions.
 - iv) Inclined strata with faults, with and without intrusions.
 - v) Maps showing unconformities with and without intrusions
 - vi) Map showing folded strata with and without intrusions.
 - vii) Maps showing combined features such as folds, faults and unconformities with and without intrusions.
2. Tracing and completion of outcrops by given data (a minimum of 5 maps)
3. Prismatic compass survey – Open traverse, Close traverse and Radial traverse using Auto Level/Dumpy Level

TEXT BOOKS

1. Structural Geology - By M. P. Billings,
2. Fundamentals of Structural Geology - By N. W. Gokhale
3. Principles of structural Geology - C.M. Novin
4. Structural geology - De Sitter
5. Theory of Structural Geology- Gokhale, N.W.
6. Structural Geology – Fundamentals and Modern developments. – Ghosh. S.K
7. Structural and Tectonic, Principles- P.C. Bedgley
8. An Introduction to structural Geology - E.W. Spencer
9. Fundamentals of structural Geology- Park, P.G.
10. Engineering Geology- Parbin Singh
11. Principles of Engineering Geology - Bangar

B.Sc V Semester Geology Theory

GEODSET 5.2A (Elective – 1): Ore Processes, Indian Mineral Deposits and Exploration Geology (Credit - 3)

Total 60 Lectures

Course Objectives:

The course deals with the study of various processes of formation of ore deposits. It also deals with the study of various mineral deposits with respect to their mode of occurrence, origin, mineralogy, geologic and geographic distribution, and uses. Further, it also deals with the identification of economic ore minerals in hand specimens.

Learning Outcome:

On completion of the course, the student will have gained sufficient knowledge regarding the formation of various ore deposits and also be able to identify the ore minerals and their distribution in India.

UNIT	TOPIC	Hrs
I	A. ORE PROCESSES	12
	Introduction , syngenetic and epigenetic deposits. Controls of ore deposition – Structural, stratigraphic, physical and chemical. Magmatic concentration: Early (dissemination, segregation, injection) and late magmatic (residual liquid segregation and injection; and immiscible liquid segregation and injection), Sublimation. Metamorphosis and Contact metamorphism deposits.	
II	Hydrothermal- Epithermal, mesothermal, hypothermal, cavity filling, crustification, fissure veins (ladder vein, stocks, box work, gash veins), replacement deposits.	12
	Sedimentation Deposits: Precipitation from carbonate solution; precipitation in oxidizing environment. Features of sedimentary ore deposits. Banded Iron Formation (BIF). Mechanical concentration deposits – alluvial, eluvial, eolian and beach placers (detrital/heavy minerals).	
III	Residual deposits- lateritisation and bauxitisation. Evaporites- salt deposits; Oxidation and supergene enrichment- Gossan, Zone of oxidation, supergene enrichment zone and Primary zone.	12
IV	B. INDIAN MINERAL DEPOSITS	12
	Ore Mineral: Definition of ore mineral, ore, gangue, tenor. Strategic and critical minerals. Introduction to metallic and non metallic ore minerals. Introduction, Mineralogy, Uses and distribution of following ore minerals in India.	
	Metallic: Iron, Manganese, Copper, Aluminum (Bauxite), Gold Medicinal use of minerals and ore minerals.	
	Non Metallic: Origin of Coal, types of coal, uses and its distribution in India. Origin of Petroleum, Migration, accumulation, uses and its distribution in India. Materials used for Abrasives, Refractories, Ceramic and Cement Industries.	
	C. EXPLORATION GEOLOGY	
V	Introduction: Introduction to Mineral exploration. Principles, Methods and applications of Geophysical, Geomorphological, Remote Sensing,	12

	Geobotanical and Geochemical prospecting methods. Earth's magnetic and gravitational fields. General principles and applications of - Magnetic methods and gravity method	
	General principles of electrical methods; Schlunberger and Wenner configuration, Resistivity profiling and Vertical Electrical Sounding. Interpretation of resistivity curves.	
	General principles and applications of Seismic method – Reflection and Refraction	

B.Sc V Semester Geology Practical

GEODSEP 5.2A (Elective – 1): INDIAN MINERAL DEPOSITS AND EXPLORATION GEOLOGY (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. Identification and physical properties of the following Ore minerals: Iron- Hematite, Magnetite, Lemonite, Pyrite; Copper – Native copper, Chalcopyrite, Malachite, Azurite; Manganese – Pyrolusite, Psilomelane; Lead and Zinc – Galena, Sphalerite; Stibnite, Bauxite, Chromite, Realgar, Orpiment, Magnesite, Limestone & Dolomite.
2. Varieties of Coal- Peat, Lignite, Bituminous & Anthracite.
3. Preparation of maps showing distribution of following ore/fuel deposits in India: Iron, Copper, Gold, Lead & Zinc, Bauxite, Coal & Petroleum
4. Vertical electrical soundings using resistivity meter (Only for demonstration). Plotting of the given resistivity data and interpretation (4 maps).
5. Interpretation of given Seismic Profiles (4 maps).
6. Ore reserve estimation problems (4 Problems)

TEXT BOOKS

- | | |
|---|--|
| 10. Economic Mineral Deposits | - Bateman Allan .M. |
| 11. Economic Geology | - Charles Richardson |
| 12. Mineral Deposits | - Lindgren W |
| 13. Introduction to Ore-Forming Processes | - Lawrence Robb |
| 14. Ore Geology and Industrial Minerals | - Anthony M Evans |
| 15. Ore Deposits of India | - G.K.Gokhale & Rao T.C. |
| 16. Indian Mineral Resources | - S.Krishnaswamy |
| 17. Minerals of Karnataka | - B.P.Radhakrishna |
| 18. Treatise of Minerals of India | - R.K.Sinha |
| 19. Exploration Geophysics | - Gadallah Mamdouh R., Fisher, Ray |
| 20. Modern Geophysics In Engineering Geology- | D. M. McCann, M. Eddleston, P. J. Fenning and G. M. Reeves |

B.Sc V Semester Geology (Theory)

GEODSET 5.2B (Elective – II): Marine Geology (Credits -4)

Total 60 Lectures

Course Objectives:

To provide essential concepts of oceanography and marine/coastal processes.

To study the tectonics, geology, and economic marine resources.

Learning Outcomes:

A student will understand and learn about the basic concepts of marine science with respect to geology which enable them to work as a marine geologist.

UNIT	TOPIC	Hrs
	Marine Geology	
I	Ocean basins: Pacific, Atlantic and Indian Oceans. Coriolis Effects, Ocean circulation, Ocean salinity, Techniques used to study ocean bathymetry. Concept of Plate Tectonics and sea floor spreading.	12
II	Marine Provinces, Morphological features of the ocean floor, Continental slope, shelf and Abyssal plains, Mid Oceanic Ridges, , Ocean trench, Ocean islands, Atolls. Brief account of Indian Coasts – West & East Coasts of India. Coastal Emergence and Submergence. Sea level changes with special reference to Holocene and present scenario.	12
III	Coastal processes – Nearshore and offshore processes- Fetch, Swell and Sea waves – Wave height, Wave period, wave length; Breaker wave, Longshore currents, Wave refraction – Convergence and divergence, rip currents. Tombolo process. Beach morphology – Erosion & Accretion process, Typical beach profile; Estuarine morphology; Erosional and Depositional features- Longshore Bar, Ridge & Runnel, Ebb and Flood deposits; deltaic deposits. Coastal Wetlands and Mudbanks.	12
IV	Clastic Sedimentation in different marine environments: Biogenic sedimentation; Chemogenic sedimentation. Marine/coastal sediments; beach and estuarine depositional environments. Sediment transport.	12
V	Coastal Zone Regulations (CRZ), Exclusive Economic Zone (EEZ); Minerals in the EEZ of India. Oceanic Mineral deposits, with special reference to Phosphate & Manganese nodules. Shore protection measures – Protection walls, groins & dikes.	12

B.Sc V Semester Geology Practical

GEODSEP 5.2B (Elective – II): MARINE GEOLOGY (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. Preparation of ocean current and salinity map.
2. Sketching and labelling of ocean profile.
3. Plotting of Beach profiles and interpreting the erosion and accretion using the given data.
4. Textural analysis using the given sieve data. Grain size plots – univariant, bivariant plots; Visher's probability curves; and interpretation of the depositional environment.

TEXT BOOKS

1. Trujillo, A. P and Thurman H., 2013. Essentials of Oceanography, Eastern Economy Edition, PHI Learning Pvt. Ltd, New Delhi.
2. Kennett J P., 1981. Marine Geology, Prentice Hall.
3. Pinet ., Invitation to Oceanography
4. Qasim, S.Z., 1996, India's Exclusive Economic Zone, Omega Scientific Roonwal, G.S. Publishers.
5. Thurman, H V. and Trujillo A., 2003, Introductory Oceanography, Prentice Hall.

B.Sc V Semester Geology

GEOSECT 5.3 GEMOLOGY (Credit -2)

Total 25 Lectures

Unit	Topic	Hours
Unit I	Gemstones: Definition. Minerals and Mineraloids. Natural and synthetic Gems. Precious and Semi precious gems.	5
Unit II	Gemstones in the Elements, Oxides, Silicates, Carbonate and Phosphates	5
Unit III	Fundamental qualities necessary in a gem, including hardness, specific gravity, crystallography, refractive index, pleochroism, critical angle, luminescence, and absorption spectra.	10
Unit IV	Specifications - Carat, Color, Clarity, Cuts, Rarity, Durability. Types of gemstones and their uses. Organic gem materials: Amber, Ivory, Coral and Pearl.	5

Text Books

- | | |
|---|---------------|
| 1. Rutley's Elements of Mineralogy | H.H. Read |
| 2. Mineralogy for students | M.I. Batty |
| 3. Mineralogy | Berry & Mason |
| 4. Gemology | Peter G Read |
| 5. Gems and Gem Industry in India (JGSI M-45) | R.V. Karanth |
| 1. Gemstones Enchanting Gifts of Nature | R.V. Karanth |

B.Sc VI Semester Geology Theory
GEODSET 6.1: Hydrogeology & Geochemistry
(Credits - 3)

Total 60 Lectures

Course Objectives

To impart knowledge about hydrosphere including surface and groundwater, its distribution and movement on the earth and inside earth, conservation, groundwater recharge structures.

Learning Outcomes

On completion of the course, the student will have gained an understanding of:

1. Hydrogeological concepts, occurrence of groundwater, water bearing properties of rocks etc.
2. Groundwater augmentation and recharge structures

UNIT	TOPIC	Hrs
	A. HYDROGEOLOGY	
I	Hydrological Cycle- Evaporation, transpiration, evapotranspiration, precipitation, sublimation, infiltration, runoff, groundwater flow. Water Resources: Surface water and its types. Groundwater and its sources; and sustainable water management.	12
II	Hydrological properties of water bearing materials: Specific yield, specific retention, porosity, permeability, types of openings in rocks. Subsurface distribution of water: Zone of aeration, zone of saturation, groundwater table, perched water table.	12
III	Aquifers: Definition, Classification- Confined and unconfined aquifers, aquiclude, aquifuge, aquitard and Darcy's Law. Seepage: Definition, factors controlling seepage, influent and effluent seepage. Springs: Definition, classification- gravity and non gravity; types of springs- bedding plane, contact, thermal and artesian. Wells and types of wells- dug well, bore well and artesian well.	12
IV	Occurrence of Groundwater in different terrains – weathered, hard and stratified rocks. Water Harvesting: Rainwater harvesting and its importance. Groundwater recharge structures. Water quality parameters – Temperature, pH, conductivity, dissolved oxygen (DO), turbidity.	12
	B. GEOCHEMISTRY	
V	Introduction: Concept of Geochemistry, Structure and atomic properties of elements. The Periodic Table. Goldschmidt's classification of the elements and distribution in the Earth – Lithophile, Siderophile, Chalcophile & Atmophile. Geochemical Cycle. Stability of Minerals.	12

B.Sc VI Semester Geology Practical

GEODSEP 6.1: HYDROGEOLOGY & GEOCHEMISTRY (Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. **Water Quality Interpretation:** Based on given data calculate-Na/RSC/SAR and draw Pie/Bar/Stiff/Gibbs/Piper diagrams and comment on the suitability/quality of the water.
2. Preparation and interpretation of water table maps using the given data.
3. Estimation of porosity and permeability from the given aquifer data.
7. **GEOCHEMISTRY:** Estimation of metal content in the given ore by volumetric method.
 - i) Calcium
 - ii) Hematite
 - iii) Manganese

TEXT BOOKS

1. Groundwater - By Todd D. K., John Wiley and Sons.
2. Groundwater - By K. V. Karanath,
3. Groundwater and Tube wells - By S.P. Garg, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Hydrogeology - By Stanley N. Davis, Roger J. M. De Wiest, John Wiley and Sons.
5. Ground water McGraw Hill. New York. Tolman., G.F. 1937
6. Ground water Hydrology. John wiley & Sons. Todd, D.K. 1959
7. Ground water, Wiley Eastern. Rangunath, H.M. 1983
8. Ground water Resources evaluation, McGraw Hill. Walton, W.C. 1970.
9. Ground water Assessment Development & management Tata McGraw Hill. Karanath, K.R. 1987.
10. Principles of Geochemistry – Brian Mason
11. Essentials of geochemistry. Jones & Bartlett Publishers

B.Sc VI Semester Geology Theory

GEODSET 6.2A (Elective – III): Remote Sensing & GIS (Credits - 3)

Total 60 Lectures

Learning Objectives

This course is designed as an introduction to the application of remote sensing as a tool in geologic applications. The basic concepts of remote sensing and interpretations are covered. This course also introduces the basic principles and techniques of Geographic information Systems (GIS)

Learning Outcomes

Student will be able to:

1. Explain basic principles of remote sensing, significance, advantages and limitations.
2. Understand the application of remote sensing for interpretation of geological features such as - lithology, structure and geomorphologic features.
3. Develop a basic knowledge of GIS

UNIT	TOPIC	Hrs
	REMOTE SENSING AND GIS	
I	Introduction. Fundamentals of Remote Sensing. Electromagnetic spectrum- Visible & Infrared spectrum Brief history and types of Indian Remote Sensing Satellites. Applications of aerial photographs/satellite imageries in Geoscience & Geomorphological studies.	12
II	Passive and active sensors; Image Resolutions- spatial, spectral, radiometric and temporal. Types of Images: Panchromatic image, True Color & False color composite. Thematic images General principles and uses of pocket and mirror stereoscopes.	12
III	Parts of aerial photograph: Fiducial Marks Types of aerial photograph- vertical, inclined/oblique photographs Elements of photo/image interpretation: Photo elements- color, tone, texture, pattern, shape, size, shadow and associated features.	12
IV	Elements of photo/image interpretation: Geotechnical elements- landforms, vegetations, drainage patterns and density, erosional pattern and land use. GPS- General principles and uses.	12
V	Geographical Information System (GIS)- Introduction, Vector and Raster models. Components, data type (spatial and non spatial) and data structure. Thematic maps and GIS applications.	12

B.Sc VI Semester Geology Practical
GEODSEP 6.2A (Elective – III): Remote Sensing & GIS
(Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50

Lectures

REMOTE SENSING: (Draw neat sketches wherever necessary)

- i. Depth perception exercises.
- ii. Identification of the hidden features through the study of Stereograms’.
- iii. Interpretation of Aerial photos, stereo-pairs and satellite images using stereoscopes (tracing and description of a minimum of 5 aerial photos and 5 satellite images).
- iv. Tracing and labeling of Geological features- structures & Rock formations; and Geomorphologic landforms

TEXT BOOKS

1. Aerial Photographic interpretation and applications- D.R.Leudar
2. Manual of photogrammetry - M.Thomson,Ed
3. Manual of Remote Sensing - R.G.Reeves, Ed
4. Remote Sensing in Geology- P.S.Siegal & A.R.Gillespie
5. Text book of Remote Sensing and Geographical information systems - M.Anji Reddy
6. Photogeology and Regional Mapping - By J. A. E. Allum, Pergamon Press.
7. Principles and Applications of Photogeology - By S. N. Pandey.
8. Photogeology - By Victor C. Miller, Mc Graw Hill Book Co.Inc.
9. Remote Sensing- Principles and Interpretation - By F. F. Sabins,
10. Remote sensing and image interpretation. John Wiley & Sons -T.M and R.W. Kiefer.
11. Photogeology. McGraw-Hill Publishers, New York -Miller, V.C
12. Photogeology and regional mapping- Oxford- Allum, J.A.E (1978).
13. Handbook of aerial photography and interpretation- Rampal, K.K (1999).
14. Remote sensing and its application. Universities Press Ltd., Hyderabad-Narayan, L.R.A (1999).

B.Sc VI Semester Geology Theory

GEODSET 6.2B (Elective – IV): Environmental Geology and Engineering Geology (Credits - 3)

Total 60 Lectures

Learning Objectives

This course is designed as an introduction to man and environment – air, water and soil pollution. Hazards – natural and manmade. The engineering aspects are helpful to understand the mechanism of application of engineering properties of rocks.

Learning Outcomes

Student will be able to:

1. Need of alternative energy resources
2. Understand about environment and pollution, human interference.
3. Understand various natural and manmade hazards, disaster management.
4. Understand the rock properties for construction designs of major constructions such as dams, bridges, tunnels etc.

	ENVIRONMENTAL GEOLOGY	
I	Definition of ecology and environmental geology, man and environment, scope and importance. Role of Geology in environmental studies. The physical environment - Atmosphere, hydrosphere, lithosphere and biosphere. Anthropogenic environment	12
II	Pollution- air, water and soil pollution - causes and effect. Heavy metal pollution in ground water. Greenhouse effect, Global Warming and their effect on the environment. Ozone depletion	12
III	Hazards: Definition, types of hazards- natural (volcano, earthquake, tsunami, landslide, cyclone and flood) and manmade hazards (soil erosion, coastal erosion). Hazard/disaster management – hazard zoning maps, risk assessment. Waste management. Nuclear waste, Plastic waste, Electronic waste – effects. Environmental Hot spots. Desertification – causes and mitigation	12
	ENGINEERING GEOLOGY	
IV	Role of Engineering Geologist in planning, design and construction of major manmade structures. Engineering properties of rocks: crushing strength, porosity, density, abrasive resistance. Concept mechanism and significance of rock quality designation (RQD), Rock structure rating (RSR), Rock mass rating (RMR) and Tunnelling Quality Index (Q)	12
V	Geological investigation for construction of dams, tunnels with remedial measures. Building materials - sand, building and dimension stones, aggregates, lime and cement, clays and clay products. Use of Dolerite, Granite, Gneiss, Marble, Slate and Sandstone as decorative stones.	12

B.Sc VI Semester Geology Practical
**GEODSEP 6.2B (Elective – IV): Environmental Geology &
Engineering Geology**
(Credit -1)

Max. Marks: 50

Time: 3 hrs/week

Total 50 Lectures

1. Tracing hazard zoning maps of India – Earthquake, Floods, Landslides
2. Interpretation of quality of water sample and Air using the given data.
3. Solving of dip and strike problems
4. Solving of Borehole problems (3 point problem).
5. Identification of suitable site for dam and tunnel construction using the given geological maps.
6. Soil Texture analysis and interpretation from the given data.

TEXT BOOKS

1. Valdia K.S (1987) Environmental Geology – Indian Context –Tata Mc Graw Hills
2. Geomorphology and Environmental Geo science. Willey international
3. Donald R coates, 1981, Environmental Geology, John wiley and sons
4. Peter T Elawan ,1970. Environmental Geology, Harper & Raw
5. Keller E.A (1978) environmental Geology –Bell &Howell USA
6. Bryante (1985) Natural Hazards Cambridge University Press.
7. Engineering Geology- Parbin Singh
8. Engineering Geology- F.C.Bell
9. Principles of Engineering Geology - Bangar
10. Environmental Geology – Indian Context - By K.S.Valdia
11. Geology, Environment and Society – By K S Valdia
12. Coping with natural hazards – Indian Context – By K.S.Valdia
13. Environmental Geology – By Keller
14. Engineering and Environmental Geology - By Árpád Dávid

B.Sc VI Semester Geology
GEOSECT 6.3: Mining Geology
(Credits -2)

Total 25 Lectures

Unit	Topic	Hours
Unit I	Introduction- Role of geology in mining industry. Definition of mining terms- shaft, hanging wall, adit, roof, drive, cross cut, tunnel, raise, winze, stopes- types.	5
Unit II	Methods of mining- Surface methods- Alluvial mining –pan & betea, sluicing, Hydraulic, Dredging. Open cast mining (benches, explosives, working slope) and quarrying. Mining equipments – Dragline, power shovels.	10
Unit III	Underground/subsurface mining (stopping- open stopes, supported stopes). Advantages and limitations. Types of Stopes – open stopes, supported stopes, pillar supported stopes – timber supported stopes. Mine Closure methods. Impact of mining on environment.	10

Text Books

1. Text book of Mining Geology – R M Umathay
2. Text book of Mining Geology – James Park
3. An introduction to mining- Methun. Thamus, P.J. 1979
4. Mining Geology, New York- Mc Kinstry, H.E 1960
5. Mining Geology- Forrester
6. Courses in Mining Geology – Oxford & IBH, New Delhi. Arogyaswamy, R.N.P.