The University of Burdwan

Syllabus for B.Sc.(Gen.)

in

Geology

Under Choice Based Credit System

w.e.f. 2017-2018 onward

SEMESTER WISE DISTRIBUTION OF COURSES AND CREDITS
B. Sc. GENERAL PROGRAMME WITH GEOLOGY AS ONE OF THE DISCIPLINES

Courses/ (Credits)	Sem. I	Sem. II	Sem. III	Sem. IV	Sem. V	Sem. VI	Total No. of Courses	Total Credit
CC-1,2,3 (6)	3 (1A, 2A, 3A)	3 (1B, 2B, 3B)	3 (1C, 2C, 3C)	3 (1D, 2D, 3D)			12	72
DSE-1,2,3 (6)					3 (1A, 2A, 3A)	3 (1B, 2B, 3B)	6	36
AECC (2)	1	1					2	04
SEC (2)			1	1	1	1	4	08
Total no. of courses per Sem.	4	4	4	4	4	4	24	_____
Total Credit per Sem.	20	20	20	20	20	20	_____	120

Abbreviations used: CC: Core Course, DSE: Discipline Specific Elective, AECC: Ability Enhancement Course, SEC: Skill Enhancement Course

SEMESTER	COURSE OPTED	COURSE NAME	CREDIT	MARKS			No. of hours L-T-P (Per week)
				IA	ESE	TOTAL	
I	Ability Enhancement: compulsory course - I	Environmental Studies	4	--	100	100	
	DISCIPLINE 1	Core Course – 1 (Th)	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 2	Core Course - 1	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 3	Core Course - 1	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	Total		**22**			**325**	
II	Ability Enhancement: compulsory course - II	Communicative English/ MIL	2	--	50	50	
	DISCIPLINE 1	Core Course – 2 (Th)	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 2	Core Course - 2	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 3	Core Course - 2	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	Total		**20**			**275**	
III	DISCIPLINE 1	Core Course – 3 (Th)	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 2	Core Course - 3	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 3	Core Course - 3	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	Skill Enhancement Course	SEC- 1	2	10	40	50	
	Total		**20**			**275**	
IV	DISCIPLINE 1	Core Course – 4 (Th)	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 2	Core Course - 4	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 3	Core Course - 4	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	Skill Enhancement Course	SEC- 2	2	10	40	50	
	Total		**20**			**275**	

SEMESTER	COURSE OPTED	COURSE NAME	CREDIT	MARKS			No. of hours L-T-P (Per week)
				IA	ESE	TOTAL	
V	DISCIPLINE 1	DSE – 1 (Th)	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 2	DSE - 1	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 3	DSE - 1	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	Skill Enhancement Course	SEC- 3	2	10	40	50	
	Total		**20**			**275**	
VI	DISCIPLINE 1	DSE- 2 (Th)	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 2	DSE - 2	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	DISCIPLINE 3	DSE - 2	4	15	40	75	4-0-0
		Practical	2		20		0-0-4
	Skill Enhancement Course	SEC- 4	2	10	40	50	
	Total		**20**			**275**	
	TOTAL OF ALL SEMESTERS		**122**			**1700**	

When there is TUTORIAL instead of PRACTICAL in Core Courses and DSE, the distribution of Credit points and marks may vary.

B.Sc. with Geology CBCS Syllabi

CORE COURSES (CC)

CC -1: Earth System Science (Theory:04 Credits + Practical: 02 credits = 06 credits)
CC -2: Structural Geology (Theory:04 Credits + Practical: 02 credits = 06 credits)
CC -3: Crystallography and Mineralogy (Theory:04 Credits + Practical: 02 credits = 06 credits)
CC -4: Petrology (Theory:04 Credits + Practical: 02 credits = 06 credits)

DISCIPLINE SPECIFIC ELECTIVE (DSE)

DSE- 1. Stratigraphy (Theory: 04 Credits + Practical: 02 credits = 06 credits)

Or

Palaeontology (Theory: 04 Credits + Practical: 02 credits = 06 credits)

DSE- 2. Economic Geology (Theory: 04 Credits + Practical: 02 credits = 06 credits)

Or

Elements of Applied Geology (Theory: 04 Credits + Practical: 02 credits = 06 credits)

SKILL ENHANCEMENT COURSE (SEC)

SEC- 1. Geomorphology and Geotectonics (02 credits)

Or

Environmental Geology (02 credits)

SEC- 2. Field Geology - I (02 credits)

Or

Field Geology - II (02 credits)

SEC- 3. Geochemistry (02 credits)

Or

Photo Geology and Remote Sensing (02 credits)

SEC- 4. Hydrogeology (02 credits)

Or

Field Geology - III (02 credits)

ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)

1. Environment Studies (04 Credits)
2. Communicative English / MIL (02 credits)

CC-1
Earth System Science (Theory) (4 Credits)

Unit 1: Earth System Science **(9 Lectures)**

Definition and scope; General characteristics and origin of the Universe, Solar System and its planets; the terrestrial and jovian planets.
Meteorites and Asteroids
Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters and its age.

Unit 2: Solid Earth and its fluid cover **(8 Lectures)**

Internal constitution - its recognition vis-à-vis solid earth geophysics: crust, mantle, core, evidence from seismic waves and rocks
Hydrosphere, atmosphere and biosphere: Elementary idea
Nature of Earth's magnetic field

Unit 3: Plate Tectonics **(9 Lectures)**

Concept of continental drift vis-a-vis plate tectonics, sea-floor spreading
Plate boundaries: Mid Oceanic Ridges, trenches, transform faults and island arcs
Concept of isostasy, isostatic condition of India
Internal process and its superficial manifestation – volcanoes and volcanism, distribution of volcanoes: causes of earthquakes and their effects, intensity and magnitude, earthquake belts, seismic zones of India.

Unit 4: Hydrosphere and Atmosphere **(8 Lectures)**

Oceanic current system and effect of Coriolis force
Concepts of eustasy
Land-sea interaction along coast
Weather and climatic changes

Unit 5: Earth surface processes **(8 Lectures)**

Weathering; erosion; mass wasting; Geological work of wind, river and glacier
Formation of soil, soil profile and soil types

Unit 6: Introduction to the concept of time in geological studies **(9 Lectures)**

Stratigraphy: definition and scope
Brief history of development of stratigraphic principles; concepts of Neptunism, Plutonism and Uniformitarianism
Geological Time Table, introduction to geochronological methods and their application in geological studies
Fundamental laws of stratigraphy: Superposition, Faunal succession and correlation

Unit 7: Cosmic abundance of elements **(9 Lectures)**

Distribution of elements in solar system and in Earth
Introduction to chemical differentiation and composition of the Earth
General concepts about geochemical cycles

Practical (02 Credits)

Study of major geomorphic features and their relationships with outcrops through physiographic models and maps.
Detailed study of topographic sheets and preparation of physiographic description of an area
Study of distribution of cratons, mobile belts and major sedimentary basins on the map of India

SUGGESTED READINGS:

1. Duff, P. M. D., & Duff, D (Eds.) (1993) *Holmes' principles of physical geology*. Taylor & Francis.
2. Emiliani, C. (1992) *Planet earth: cosmology, geology, and the evolution of life and environment*. Cambridge University Press.
3. Gross, M. G. (1977) *Oceanography: A view of the earth*.

CC-2
Structural Geology (Theory) (4 Credits)

Unit 1: Basic structural elements **(12 Lectures)**

Introduction to structural geology; Diastrophic and non- diastrophic structures; Components of structural elements: planar and linear features, concept of dip and strike, trend and plunge, rake/pitch; Application of primary sedimentary and igneous structure in structural geology for determining younging direction; Unconformity and its types.

Unit 2: Rock deformation **(12 Lectures)**

Concept of rock deformation: Stress and Strain in rocks, Strain ellipse and ellipsoids of different types and their geological significance.

Unit 3: Folds **(12 Lectures)**

Fold morphology; Geometric classification, mechanics of folding: Buckling, Bending, Flexural slip and flow folding; genetic classification of folds

Unit 4: Foliation and lineation **(12 Lectures)**

Types of foliations and lineations, their tectonic significance and relationship with other structures

Unit 5: Fractures and faults **(12 Lectures)**

Classification of fractures and faults and their relationship with strain
Effects of faulting on the outcrops
Geologic/geomorphic criteria for recognition of faults and determination of net slip

Practical (02 Credits)

Study of clinometers/Brunton compass; Identification of different types of folds/faults from block models; Basic idea of topographic contours, Topographic sheets of various scales.
Introduction to Geological maps: Lithological and Structural maps, preparation of cross section profile from a geological map.

SUGGESTED READINGS:

1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
3. Park, R. G. (2004) Foundations of Structural Geology.Chapman& Hall.
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed).

Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill

CC-3
Crystallography and Mineralogy (Theory) (04 credits)

Unit-1: **(7 Lectures)**
Crystals and their characters:

Unit-2: **(7 Lectures)**
Crystal form, face, edge, solid angle; Interfacial angle and their measurements; Crystallographic axes and angles.

Unit-3: **(7 Lectures)**
Crystal parameters, Weiss and Miller system of notations;

Unit-4: **(9 Lectures)**
Symmetry elements and description of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.

Unit-5: **(7 Lectures)**
Introduction to Mineralogy, Definition and characters of mineral;

Unit-6: **(9 Lectures)**
Common physical properties of minerals; Chemical composition and diagnostic physical properties of minerals such as: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Chlorite, Olivine, Epidote, Calcite.

Unit-7: **(7 Lectures)**
Polarizing microscope, its parts and functioning; Ordinary and polarized lights; Common optical properties observed under ordinary, polarized lights and crossed nicols.

Unit-8: **(7 Lectures)**
Optical properties of some common rock forming minerals (Quartz, Orthoclase, Microcline, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite).

Practical (02 Credits)

- **Crystallography:**

Study of symmetry elements of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.

- **Mineralogy:**

Study of physical properties of minerals mentioned in theory course. Use of polarizing microscope; Study of optical properties of common rock forming minerals mentioned in theory course.

Books Recommended:

1. Dana, E.S. and Ford, W.E., 2002. A textbook of Mineralogy (Reprints).
2. Flint, Y., 1975. Essential of crystallography, Mir Publishers.
3. Phillips, F.C., 1963. An introduction to crystallography. Wiley, New York.
4. Berry, L.G., Mason, B. and Dietrich, R.V., 1982. Mineralogy. CBS Publ.
5. Nesse, D.W., 1986. Optical Mineralogy. McGraw Hill.
6. Read, H.H., 1968. Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby and Co.
7. Berry and Mason, 1961. Mineralogy. W.H. Freeman & Co.
8. Kerr, B.F., 1995. Optical Mineralogy 5th Ed. Mc Graw Hill, New York.

CC- 4
Petrology (Theory) (04 Credits)

Igneous Petrology

Unit-1: **(7 Lectures)**

Magma: definition, composition, types and origin; Forms of igneous rocks; textures of igneous rocks.

Unit-2: **(7 Lectures)**

Reaction principle; Differentiation and Assimilation; Crystallization of unicomponent and bicomponent (mix-crystals); Bowen's reaction series.

Unit-3: **(7 Lectures)**

Mineralogical and chemical classification of igneous rocks.

Unit-4: **(7 Lectures)**

Detailed petrographic description of Granite, Granodiorite, Rhyolite, Syenite, Phonolite, Diorite, Gabbro.

Sedimentary Petrology

Unit-5: **(7 Lectures)**

Processes of formation of sedimentary rocks; Classification, textures and structures of sedimentary rocks.

Unit-6: **(7 Lectures)**

Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate,

breccia, sandstone, greywacke, shale, limestones.

Metamorphic Petrology

Unit-7: **(9 Lectures)**

Process and products of. metamorphism; Type of metamorphism. Factors, zones and grade of metamorphism; Textures, structures and classification of metamorphic rocks.

Unit-8: **(9 Lectures)**

Petrographic details of some important metamorphic rocks such as - slate, , schists, gneiss, quartzite, marble.

Practical (02 Credits)

- **Igneous Petrology:**

Identification of rocks: On the basis of their physical properties in hand specimen; and optical properties in thin sections.

- **Sedimentary and metamorphic Petrology:**

Identification of sedimentary and metamorphic rocks both in hand specimen and thin sections.

Books Recommended:

1. Turner, F.J. & Verhoogen, J., 1960, Igneous & Metamorphic petrology. McGraw Hill Co.
2. Bose, M.K., 1997. Igneous petrology. World press
3. Tyrell, G. W., 1989. Principles of Petrology. Methuren and Co (Students ed.).
4. Ehlers, WG, and Blatt, H., 1987. Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
5. Moorhouse, WW., 1969. The study of rocks in thin sections. Harper and sons.
6. Friedman & Sanders, 1978. Principles of Sedimentology. John Wiley and sons.
7. Pettijohn, F.J., 1975. Sedimentary rocks, Harper & Bros. 3rd Ed.
8. Prasad, C., 1980. A text book of sedimentology.
9. Sengupta. S., 1997. Introduction to sedimentology. Oxford-IBH.
10. Turner, F.J., 1980. Metamorphic petrology. McGraw Hill.
11. Mason, R., 1978. Petrology of Metamorphic Rocks. CBS Publ.
12. Winkler, H.G.C., 1967. Petrogenesis of Metamorphic Rocks. Narosa Publ.

DISCIPLINE SPECIFIC ELECTIVE (DSE)

DSE-1
Straigraphy (Theory) (4 credits)

Unit 1: **(15 Lectures)**

Definition, Principle of stratigraphy; Geological Time Scale and stratigraphic classification; Physiographic division of India.

Unit 2: **(15 Lectures)**

Study of following Precambrian succession: Dharwar, Cuddapha, Vindhyan and Delhi Supergroups; Brief idea of Palaeozoic succession of northwestern Himalaya; Triassic of Spiti; Mesozoic type seccession of Kutch and Rajasthan; Cretaceous of Tiruchirapalli;

Unit 3: **(15 Lectures)**

Study of following type localities: Gondwana and Deccan Trap.

Unit 4: **(15 Lectures)**

Palaeogene-Neogene sequences of northwest Himalaya and Assam.

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Practical (02 Credits)

Preparation of lithostratigraphic maps of India showing distribution of important geological formations.

Books Recommended:

1. Wadia, D., 1973. Geology of India. Mc Graw Hill Book co.
2. Krishnan, M.S., 1982. Geology of India and Burma, 6th Edition. CBS Publ.
3. Ravindra Kumar, 1985. Fundamentals of Historical Geology & Stratigraphy of India. Wiley Eastern.

Or

Palaeontology (Theory) (04 Credits)

Unit-1: **(15 Lectures)**

Palaeontology: definition, Fossils: definition, characters, binomial nomenclature in taxonomy, mode of preservation, condition of fossilization and significance of fossils.

Unit 2: **(15 Lectures)**

Morphology and geological distribution of brachiopods, pelecypods, cephalopods.

Unit 3: **(15 Lectures)**

Morphology and geological distribution of trilobite, echinoidea.

Unit 4: **(15 Lectures)**

Evolutionary history of horse; Morphology, distribution and significance of Gondwana flora.

Practical (02 Credits)

Morphological characters, systematic position and age of fossil genera pertaining to brachiopods, pelecypods, cephalopods, and Echinoids.

1. Shrock, R.R. & Twenhoffel, W.H., 1952. Principles of Invertebrate Paleontology. CBS Publ.
2. Swinerton, HH., 1961. Outlines of Paleontology. Edward Arnold Publishers
3. Jain, P.C. & Anantharaman, M.S., 1983. Paleontology: Evolution & Animal Distribution. Vishal Publ
4. Lehmann, U., 1983. Fossil Invertebrate. Cambridge Univ. Press.
5. Rastogi, 1988. Organic evolution. Kedrnath and Ramnath Publ..

DSE- 2

Economic Geology (04 Credits)

Unit-1: **(15 Lectures)**

Concept of ore and ore deposits, ore minerals and gangue minerals; Tenor of ores; Metallic and non-metallic ore minerals; Strategic, Critical and essential minerals.

Unit-2: **(15 Lectures)**

Processes of formation of ore deposits; Magmatic, contact metasomatic, hydrothermal, sedimentation,.

Unit-3: **(15 Lectures)**

Study of important metallic (Cu, Pb, Zn Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesite, mica).

Unit-4: **(15 Lectures)**

Distribution of coal and petroleum in India.

Practical (02 Credits)

Study of ore and economic minerals in hand specimen; Preparation of maps showing distribution of important metallic and non-metallic deposits and important coal and oil fields of India.

Books Recommended:

1. Brown, C. and Dey, A.K.1955. Indian Mineral Wealth. Oxford Univ.
2. Gokhale, K.V.G.K. and Rao, T.C., 1983. Ore Deposits of India. East West Press Pvt. Ltd.
3. Jense, M.L. and Bateman A.M., 1981. Economic Mineral Deposits. John Wiley and Sons.
4. Krishnnaswamy, S., 1979. India's Minerals Resources. Oxford and IBH Publ.
5. Deb, S., 1980. Industrial minerals and Rocks of India. Allied Publishers Pvt. Ltd.
6. Umeshwar Prasad, 2003. Economic Geology. CBS Publishers and distributers.
7. Sharma, N.L. and Ram, K.V.S., 1972. Introduction to India's Economic Minerals, Dhanbad.

Or

Elements of Applied Geology (Theory) (04 Credits)

Unit-1: **(7 Lectures)**
Engineering properties of rocks and Soils.

Unit-2: **(7 Lectures)**
Soil and Soil groups of India.

Unit-3: **(9 Lectures)**
Dam, Types and their geological and environmental considerations; Geological problem of reservoirs.

Unit-4: **(7 Lectures)**
Tunnels: geology, structure, seepage problem and role of water table;

Unit-5: **(7 Lectures)**
Landslides: classification, causes and preventative measures.

Unit-6: **(9 Lectures)**
Mineral exploration: Elementary idea of geological and geophysical prospecting.

Unit-7: **(7 Lectures)**
Elementary idea of mining.

Unit-8: **(7 Lectures)**
Environmental considerations for mining.

Practical (02 Credits)

Surveying by Plane Table/Theodolite; Preparation of engineering geological maps; Engineering properties and identification of building stones. Identification of various models of landslide, tunnel and dam. Study of soil profiles. Models of reserve estimation

Books Recommended:

1. Valdiya, K.S., 1987. Environmental Geology – Indian Context. Tata McGraw Hill.
2. Rajendran S., 2007. Mineral Exploration : Recent Strategies.
3. Dobrin, M.B. & Savit, CH., 1988. Introduction to Geophysical Prospecting, McGraw-Hill.
4. Arogyaswamy, R.N.P., 1973. Courses in Mining Geology. Oxford and IBH Publ.
5. Parasins, D.S., 1997. Principles of applied geophysics. Chapman Hall.
6. Krynine D.P. and Judd W.R., 1957. Principles of Engineering Geology & Geotechnics. McGraw-Hill Book
7. Kesavulu, N.C., 2009. A text book of engineering geology. Macmillan P publishing India Ltd.
8. Crozier. M.J., 1989. Landslides: causes, consequences and environment. Academic Press.
9. Readman, J.H., 1979. Techniques in Mineral exploration. Applied Science Publishres.
10. Bell, F.G., 1983. Fundamentals of Engineering Geology. Butterworth and Co.

SKILL ENHANCEMENT COURSE (SEC)

SEC-1
Geomorphology and Geotectonics (2 Credits)

Unit-1: **(10 Lectures)**

Basic principles of Geomorphology, geomorphological cycles, weathering and erosion; Geomorphic mapping- tools and techniques.

Unit-2: **(10 Lectures)**

Epigene/exogenic processes: degradation and aggradation. Hypogene/endogenic processes; Diastrophism and volcanism, Extraterrestrial processes; Geological work of wind, glacier, river, underground water and ocean.

Unit-3: **(10 Lectures)**

Earth as a dynamic system. Elementary idea of continental drift, sea-floor spreading and mid-oceanic ridges. Paleomagnetism and its application.

Unit-4: **(10 Lectures)**

Plate Tectonics: the concept, plate margins, orogeny, deep sea trenches, island arcs and volcanic arcs.

Books Recommended:

1. Allen, P., 1997. Earth Surface Processes. Blackwell
2. Bloom, A.L., 1998. Geomorphology: A systematic Analysis of Late Cenozoic Landforms (3rd Edition). Pearson Education, Inc.
3. Keary, P. and Vine, F.J., 1997. Global Tectonics. Blackwell and crustal evolution. Butterworth-Heinemann.
4. Kale, V.S. and Gupta, A., 2001. Introduction to Geomorphology. Orient Longman Ltd.
5. Moores, E and Twiss. R.J., 1995. Tectonics. Freeman.
6. Patwardhan, A. M., 1999. The Dynamic Earth System. Prentice Hall.
7. Summerfied, M.A., 2000. Geomorphology and Global tectonic. Springer Verlag.
8. Valdia, K.S., 1988. Dynamic Himalaya. Universities Press, Hyderabad.
9. WD Thornbury, 2002. Principles of Geomorphology. CBS Publ. New Delhi.

Or

Environmental Geology (2 Credits)

Unit-1: **(10 Lectures)**

Earth and its spheres: atmosphere, hydrosphere, lithosphere, biosphere and Man; Earth Material.

Unit-2: **(10 Lectures)**

Energy budget: Solar radiation; Global environments: coastal, riverine, desertic, tropical, cold, polar; Concept of global warming and climate change.

Unit-3: **(10 Lectures)**

Geoloigcal hazards: Earthquakes, volcanism, landslides, avalanches, floods, droughts; Hazard mitigation.

Unit 4: **(10 Lectures)**

Resource Management: Energy resources (Conventional and non-conventional), watershed management, landuse planning, management of water resources, land reclamation.

Books Recommended:

1. Verma, V.K., 1986. Geomorphology Earth surface processes and form. McGraw Hill.
2. Chorley, R. J., 1984. Geomorphology. Methuen.
3. Selby, M.J., 1996. Earths Changing Surface. Oxford University Press UK.
4. Thornbury W. D., 1997. Principles of Geomorphology Wiley Eastern Ltd., New Delhi.
5. Valdiya, K. S., 1987. Environmental Geology - Indian Context. Tata McGraw Hill New Delhi.
6. Keller, E. A., 2000. Environmental Geology. Shales E. Merril Publishing Co., Columbus, Ohio.
7. Montgomery, C., 1984. Environmental Geology. John Wiley and Sons, London.
8. Bird, Eric, 2000. Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.
9. Liu, B.C., 1981. Earthquake Risk and Damage, Westview.

SEC- 2

FIELD GEOLOGY - I (Basic Field Training) **(2 Credits)**

Students will be required to carry out 03 days field work in a suitable geological area to study the elementary aspects of field geology and submit a report thereon.

Unit 1: Orientation of Topographic sheet in field, marking location in toposheet, Bearing (Front and back). Concepts of map reading, Distance, height and pace approximation
Unit 2: Identification of rock types in field; structures and texture of rocks, Use of hand lense
Unit 3: Basic field measurement techniques: Bedding dip and strike, Litholog measurement
Unit 4: Reading contours and topography

Or

FIELD GEOLOGY - II (Stratigraphy and paleontology-related field) **(2 Credits)**

Field training along Phanerozoic basin of India
Documentation of stratigraphic details in the field
Collection of sedimentological, stratigraphic and paleontological details and their representation
Facies concept and its spatio-temporal relation (Walther's Law) and concept of facies distribution at basinal-scale
Fossils sampling techniques and their descriptions.

SEC- 3

Geochemistry (2 Credits)

Unit-1: **(10 Lectures)**

Introduction to geochemistry: basic knowledge about crystal chemistry. Types of chemical

bonds, coordination number; Colloids in geological systems, ion exchanges and geological evidence for earlier colloids; Elementary idea of Periodic Table.

Unit-2: **(10 Lectures)**

Cosmic abundance of elements; Composition of the planets and meteorites; Geochemical evolution of the earth and geochemical cycles;

Unit-3: **(10 Lectures)**

Gold Schmidt's geochemical classification of elements; Distribution of major, minor and trace elements in igneous, metamorphic and sedimentary rocks.

Unit-4: **(10 Lectures)**

Elements of geochemical thermodynamics; Isomorphism and polymorphism; Isotope geochemistry.

Books Recommended:

1. Hoefs, J., 1980. Stable Isotope Geochemistry. Springer-Verlag.
2. Klein, C. and Hurlbut, C.S., 1993. Manual of Mineralogy. John Viley and Sons, New York.
3. Krauskopf, K.B., 1967. Introduction to Geochemistry. McGraw Hill.
4. Mason, B. and Moore, C.B., 1991. Introduction to Geochemistry. Wiley Eastern.
5. Rollinson, H.R., 1993. Using geochemical data: Evaluation, Presentation, and Interpretation. Longman.

Or

Photo Geology and Remote Sensing (2 Credits)

Unit- 1: **(10 Lectures)**

Elementary idea about photogeology: electro-magnetic spectrum, types & geometry of aerial photographs; factors affecting aerial photography; types of camera, film and filters; factors affecting scale;

Unit-2: **(10 Lectures)**

Fundamentals of remote sensing; remote sensing systems; remote sensing sensors; signatures of rocks, minerals and soils. Application of remote sensing in geoscience and geomorphological studies.

Unit-3: **(10 Lectures)**

Types of Indian and Foreign Remote Sensing Satellites, Digital image processing; fundamental steps in image processing; elements of pattern recognition and image classification.

Unit-4: **(10 Lectures)**

Introduction to Geographic Information System (GIS); components of GIS; product generation in GIS; tools for map analysis; integration of GIS with remote sensing.

Books Recommended:

1. Bhatta, B., 2008. Remote Sensing and GIS. Oxford, New Delhi.
2. Gupta, R.P., 1990. Remote Sensing Geology. Springer Verlag.
3. Lilleasand, T.M. and Kiffer, R.W., 1987. Remote Sensing and Image Interpretation. John Wiley.
4. Pandey, S.N., 1987. Principles and Application of Photogeology. Wiley Eastern, New Delhi.
5. Sabbins, F.F., 1985. Remote Sensing – Principles and Applications. Freeman.
6. Siegal, B.S. and Gillespie, A.R., 1980. Remote Sensing in Geology. John Wiley.
7. Rampal K.K. 1999. Hand book of aerial photography and interpretation. Concept publication.

SEC- 4

Hydrogeology (2 Credits)

Unit-1: **(10 Lectures)**

Definition of hydrogeology, Hydrological cycle;

Unit-2: **(10 Lectures)**

Hydrological parameters - Precipitation, evaporation, transpiration and infiltration.

Unit-Unit-3: **(10 Lectures)**

Origin of groundwater; Vertical distribution of groundwater; Types of aquifers; Water bearing properties of rocks - Porosity and Permeability; specific yield, specific retention.

Unit-Unit-4: **(10 Lectures)**

Surface and subsurface geophysical and geological methods of ground water exploration; Groundwater provinces of India.

Books Recommended:

1. Karanth, K. R., 1989. Hydrogeology. Tata McGraw Hill Publ.
2. Raghunath, H. M., 1990. Groundwater. Wiley Eastern Ltd.
3. Subramaniam, V., 2000. Water-Kingston Publ. London.

Or

FIELD GEOLOGY - III (Geological Mapping and Structural Geology Field) **(2 Credits)**

Unit 1: Geological mapping, stratigraphic correlation

Unit 2: Primary (scalars and vectors) and secondary structures (linear and planar)

Unit 3: Trend, plunge, Rake/Pitch

Unit 4: Stereoplots of linear and planar structures, Orientation analyses.