

**SHRI GURU RAM RAI UNIVERSITY**

(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)



**Syllabus of GEOLOGY**  
**Effective from Academic Session**  
**2017-2018**

**B.Sc. Geology syllabus as per CBCS**

Course code	SEMESTER I	Credits	Marks for		Total marks
			*IA	*EE	
BGLC 101	Physical Geology and Structural Geology	4	30	70	100
BGLL 101	Lab course based on BGLC 101	2	30	70	100
AECC 101	Environmental Science/English/MIL Communication	4	30	70	100
	Core credits=6; Compulsory common course=4, Total credits=10	10	90	210	300
Course code	SEMESTER II	Credits	Marks for		Total marks
			*IA	*EE	
BGLC 201	Mineralogy and Crystallography	4	30	70	100
BGLL 201	Lab course based on BGLC 201	2	30	70	100
AECC 201	Environmental Science/English/MIL Communication	4	30	70	100
	Core credits=6; Compulsory common course=4, Total credits=10	10	90	210	300
Course code	SEMESTER III	Credits	Marks for		Total marks
			*IA	*EE	
BGLC 301	Petrology	4	30	70	100
BGLL 301	Lab course based on BGLC 301	2	30	70	100
BGLS 302	Geomorphology and Geotectonics	4	30	70	100
(Skill enhancement course opted by student in Geology)	Core credits=6; SEC credit=4, Total credits=10	10	90	210	300
Course code	SEMESTER IV	Credits	Marks for		Total marks
			*IA	*EE	
BGLC 401	Stratigraphy and Palaeontology	4	30	70	100
BGLL 401	Lab course based on BGLC 401	2	30	70	100
	Core credits=6; Total credits=6	06	60	140	200
Course code	SEMESTER V	Credits	Marks for		Total marks
			*IA	*EE	
BGLD 501	Economic Geology and Hydrology	4	30	70	100
BGLL 501	Lab course based on BGLD 501	2	30	70	100

	DSE credit=6; Total Credit=6	06	60	140	200
Course code	SEMESTER VI	Credits	Marks for		Total marks
			*IA	*EE	
BGLD 601	Elements of Applied Geology and Photogeology	4	30	70	100
BGLL 601	Lab course based on BGLD 601	2	30	70	100
BGLS 602	Remote Sensing and Photo geology	4	30	70	100
( SEC may be chosen by the student from one of the subjects opted in B.Sc. Course programme)	DSE credit=6; SEC credit=4 (if opted); Total Credits=10	10	90	210	300
<b>FINAL COURSE STRUCTURE-TOTAL CREDITS (GEOLOGY)- 44+8(AECC)</b>					

\*INTERNAL ASSESSMENT

\*EXTERNAL EXAMINATION

**B.Sc. Geology as per CBCS****CORE COURSES (CC)****(1<sup>st</sup> to 4<sup>th</sup> semester)****BGLC 101**

1. Physical Geology and Structural Geology (Theory:04Credits + Practical's: 02 credits = 06 credits)

**BGLC 201**

2. Mineralogy and Crystallography (Theory:04Credits+Practicals: 02 credits = 06 credits)

**BGLC 301**

3. Petrology (Theory:04 Credits + Practical's: 02 credits = 06 credits)

**BGLC 401**

4. Stratigraphy and Palaeontology (Theory:04 Credits + Practical's: 02 credits = 06 credits)

**DISCIPLINE SPECIFIC ELECTIVE (DSE)****(5<sup>th</sup> to 6<sup>th</sup> semester)****BGLD 501**

1. Economic Geology and Hydrology (Theory:04 Credits + Practical's: 02 credits = 06 credits)

**BGLD 601**

2. Elements of Applied Geology & Photogeology (Theory:04 Credits + Practical's: 02 credits = 06 credits)

**SKILL ENHANCEMENT COURSE (SEC)****(One each in 3rd, 4th, 5th and 6th semester, if opted from geology)****BGLS 302**

1. Geomorphology and Geotectonics (04 credits)

**BGLS 602**

2. Photo Geology and Remote Sensing (04 credits)

**ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)****(1<sup>st</sup> and 2<sup>nd</sup> semester)****AECC 102**

1. Environment Science (04Credits)

**AECC 202**

2. English or Modern Indian Language communication (04credit)

**Total credits (Summary)**

Core courses (Th. +Pr.) 6X4 = 24 X 03 (Three Subjects in BSc) =72

DSE (Th. +Pr.) 6X2 =12 X 03 (Three Subjects in BSc) = 36

AECC 4X2= 08 (Common in all the three subjects) =08

SEC 4 X 4= 16 (one courses each from 03 subjects + one course from any of the 03subjects)=16

**Total 132 credits to be earned in B.Sc.**

## **First semester**

### **BGLC 101 -Physical Geology and Structural Geology**

#### **Physical geology**

**Unit-I:** Introduction to geology and its scope, Earth and solar system: origin, size, shape, mass, density and its atmosphere, hydrosphere and lithosphere.

**Unit-II:** A brief account of various theories regarding the origin and age of the earth; structure of earth and its composition.

**Unit-III:** Processes of weathering and erosion: factors, types and their effects, elementary idea of geomorphic processes.

**Unit-IV:** Earthquakes: nature of seismic waves, their intensity and magnitude scale; Origin of earthquake and its type, Volcanoes: types, products and causes of volcanism, tsunami.

#### **Structural Geology**

**Unit-I:** Introduction to Structural Geology; contours, topographic and geological maps; Elementary idea of bed, dip and strike; Outcrop, effects of various structures on outcrop. Clinometer/ Brunton compass and its use, elementary idea of shear and strain.

**Unit-II:** Elementary idea of types of deformation; Folds: nomenclature and types of folds;

**Unit-III:** Faults: parts of a fault, geometrical and genetic classifications, normal, thrust and slip faults;

**Unit-IV:** definition, kinds and significance of joints and unconformity and salt dome.

### **BGLL 101- Lab course**

#### **• Physical Geology:**

Study of important geomorphological models; Reading topographical maps of the Survey of

India, Identification of geomorphic features.

#### **• Structural Geology:**

Study of clinometers/Brunton compass; Identification of different types of folds/faults from block models; Exercises on structural problems: preparation of cross section profile from a geological map.

##### **• Laboratory record:**

##### **• Viva Voce:**

#### **Books Recommended:**

1. Mahapatra, G.B., 1994. A text book of Physical geology. CBS Publishers.
2. Savindrasingh, physical geography, pravalika pub. Allahabad.
3. Billings, M.P., 1972. Structural Geology. Prentice Hall.
4. Davis, G.R., 1984. Structural Geology of Rocks and Region. John Wiley

5. Hills, E.S.,1963. Elements of Structural Geology. Farrold and Sons, London.
6. Singh,R.P., 1995.Structural Geology, A Practical Approach. Ganga Kaveri Publ ,Varanasi.
7. Jain A.K. ,advanced Structural analysis, nemchand and bros.

## **Second semester**

### **BGLC 201-Mineralogy and Crystallography**

#### **Mineralogy**

**Unit-I:** Common physical properties of minerals (form, color, lusture, streak, cleavage, fracture, hardness, and specific gravity), Chemical composition and diagnostic physical properties of silica, feldspar, amphibole, pyroxene, olivine, feldsphathoid, zeolite, carbonatite.

**Unit-II:** Classification of silicate structures, physical properties of non silicate.

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

**Unit-IV:** Optical properties of some common rock forming minerals (Quartz, Plagioclase, Microcline, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite, orthoclase).

#### **Crystallography**

**Unit-I:** Crystal form, face, edge, solid angle; Interfacial angle and their measurements; Crystallographic axes and angles.

**Unit-II:** Crystal parameters, Weiss and Miller system of notations.

**Unit-III:** Symmetry elements and description of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.

**Unit-IV:** Twinning: Laws and Types.

### **BGLL 201- Lab course**

#### **• 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.

#### **• Crystallography:**

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

#### **• Laboratory record:**

- Geological Field Training:** Students will be required to carry out 01 days field work in a suitable geological area to study the elementary aspects of field geology and submit a report there on.

#### **• Viva voce:**

#### **Books Recommended:**

1. Dana, E.S. and Ford, W.E., 2002. A textbook of Mineralogy (reprints).
2. Berry, L.G., Mason, B. and, Dietrich, R.V., 1982. Mineralogy. CB S ubl.
3. Nesse, D.W., 1986. Optical, Mineralogy. McGrawill
4. Read, H.H., 1968. Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murbyand Co.
5. Berry and Mason, 1961. Mineralogy. W.H. Freeman & Co.
6. Kerr, B.F., 1995. Optical Mineralogy 5th Ed. McGraw Hill, New York.



## Third semester

### BGLC 301-Petrology

#### Igneous Petrology

**Unit-I:** introduction to petrology, Magma: definition, composition and constitution, types and origin; Forms of igneous rocks;

**Unit-II:** Differentiation and Assimilation; Crystallization of uni-component and bi-component (mix-crystals); Bowen's reaction principle.

**Unit-III:** Mineralogical and chemical classification of igneous rocks, textures and structure of igneous rocks.

**Unit-IV:** Detailed petrographic description of Granite, Granodiorite, Basalt, Rhyolite, Syenite, Phonolite, Diorite, Gabbro and their volcanic equivalent.

#### Sedimentary Petrology & Metamorphic Petrology

**Unit-I:** Processes of formation of sedimentary rocks; Classification, textures and structures of sedimentary rocks; sedimentary facies.

**Unit-II:** Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, sandstone, greywacke, shale, limestone.

**Unit-III:** Process and products of metamorphism; Type of metamorphism. Factors, zones and grade of metamorphism; Textures and structures of metamorphic rocks.

**Unit-IV:** Petrographic details of some important metamorphic rocks such as - slate, phyllite, schist, gneiss, quartzite, marble, amphibolite, granulite.

### BGLL 301-Lab course

#### • 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.

#### • Laboratory record:

#### • Viva Voce

#### 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. Methuen and Co (Students ed.).
4. Ehlers, W.G. and Blatt, H., 1987. Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
5. Moorhouse, W.W., 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.

## Fourth semester

### BGLC 401-Stratigraphy and Palaeontology

#### Stratigraphy

**Unit I:** Definition, types of stratigraphy; Geological time scale and stratigraphic classification; Physiographic division of India.

**Unit II:** Study of following Precambrian succession: Dharwar, Rajasthan, Singhbhum, Cuddapha, Vindhyan and Mesozoic type succession of Kutch and Cretaceous of Tiruchinapalli.

**Unit III:** Gondwana: classification and importance of lower Gondwanaland Deccan Trap, stratigraphy of lesser Himalayas & higher tethyan Himalayas.

**Unit IV:** Cenozoic (Palaeogene-Neogene) sequences of Himalaya and Assam.

#### Palaeontology

**Unit-I:** Palaeontology: definition, Fossils: definition, characters, mode of preservation, condition of fossilization and significance of fossils, introduction of microfossils (foraminifera, radiolarian, conodont)

**Unit-II:** Morphology and geological distribution of phylum Mollusca and Brachiopod, gastropoda.

**Unit-III:** General morphology and geological history of Phylum Cephalopod and Arthropodation of trilobite.

**Unit-IV:** Evolutionary history of horse, elephant, man; Morphology, distribution and significance of Gondwana flora.

#### BGLL 401 Lab course

- Morphological characters, systematic position and age of fossil genera pertaining to brachiopods, pelecypods, cephalopods, trilobite and Echinacea.
- Preparation of lithostratigraphic maps of India showing distribution of important geological formations.
- **One day field work in Himalayan terrain from stratigraphic point of view.**

#### Books Recommended:

1. Wadia, D. 1973. Geology of India. McGraw 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.
4. Shrock, R.R. & Twenhoffel, W.H., 1952. Principles of Invertebrate Paleontology. CBS Publ.
5. Swinerton, H.H., 1961. Outlines of Paleontology. Edward Arnold Publishers
6. Jain, P.C. & Anantharaman, M.S., 1983. Paleontology: Evolution & Animal Distribution. Vishal Publ.

7. Lehmann, U., 1983. Fossil Invertebrate. Cambridge Univ. Press.

8. Rastogi, 1988. Organicevolution. Kedrnath and RamnathPubl.

## Fifth Semester

### BGLD 501-Economic Geology and Hydrology

#### Economic Geology

**Unit-I:** 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-II:** Processes of formation of ore deposits; Magmatic, Mechanical and residual concentration, contact metasomatic, hydrothermal, sedimentation, oxidation, supergene enrichment.

**Unit-III:** Study of important metallic (Cu, Pb, Zn, Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesite, mica), mineral resources of Uttarakhand.

**Unit-IV:** Distribution of coal and petroleum in India, gas hydrate, coal bed methane.

#### Hydrology

**Unit-I:** Definition of hydrogeology, Hydrological cycle; Water bearing properties of rocks.

**Unit-II:** Hydrological parameters - Precipitation, evaporation, transpiration and infiltration.

**Unit-III:** Origin of groundwater; Vertical distribution of groundwater; Types of aquifers;

**Unit-IV:** Surface and subsurface geophysical and geological methods of ground water exploration; Ground water resources of Uttarakhand.

#### BGLL 501 -Lab Course

- **Economic Geology:** 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.
- **Hydrology:** Study of hydrogeological models, Estimation of porosity and permeability from the given data; Preparation and interpretation of water table maps.
- **Laboratory record:**
- **Viva Voce:**

#### 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. Krishnaswamy, 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 distributors.
7. Sharma, N.L. and Ram, K.V.S., 1972. Introduction to India's Economic Minerals.
8. Karanth, K. R., 1989. Hydrogeology. Tata McGraw Hill Publ.
9. Raghunath, H.M., 1990. Groundwater. Wiley Eastern Ltd.
10. Subramaniam, V., 2000. Water-Kingston Publ. London.
11. Todd, D.K, ground water hydrology, wiley pub.

## Sixth Semester

### **BGLD 601- Applied Geology and Geomorphology and Photo Geology**

#### **Elements of Applied Geology**

**Unit-I:** Engineering properties of rocks and Soils.

**Unit-II:** Dam, Types and their geological and environmental considerations; Geological problem of reservoirs.

**Unit-III:** Tunnels: geology, structure, seepage problem and role of water table, geological investigation of road and bridge.

**Unit-IV:** Landslides: classification, causes and preventative measures, land slide in Uttarakhand.

#### **Geomorphology and PhotoGeology**

**Unit-I:** Basic principles of Geomorphology, geomorphological cycles, weathering and erosion.

**Unit-II:** Epigene/exogenic processes: degradation and aggradation. Diastrophism and volcanism, Geological work of wind, glacier, river, underground water and ocean, geomorphology of Uttarakhand.

**Unit-III:** Elementary idea about photo geology: electro-magnetic spectrum, types & geometry of aerial photographs; factors affecting aerial photography; types of camera, film and filters.

**Unit-IV:** Fundamentals of remote sensing; remote sensing sensors; signatures of rocks, minerals and soils. Application of remote sensing geomorphological studies.

#### **BGLL601 Lab course**

- Surveying by Plane Table. Preparation of engineering geological maps; Engineering properties and identification of building stones. Identification of various models of landslide, tunnel and dam. Grain size analysis of soil and sediments.

#### **•Laboratory record:**

#### **• Viva Voce**

- **One day visit any dam site of Uttarakhand.**

#### **Books Recommended:**

1. Krynine D.P. and Judd W.R., 1957. Principles of Engineering Geology & Geotechnics. McGraw-Hill Book
2. Kesavulu, N.C., 2009. A text book of engineering geology. Macmillan Publishing India Ltd.
3. Crozier, M.J., 1989. Landslides: causes, consequences and environment. Academic Press.
4. Bell, F.G., 1983. Fundamentals of Engineering Geology. Butterworth and Co
5. Allen, P., 1997. Earth Surface Processes. Blackwell
6. Bloom, A.L., 1998. Geomorphology: A systematic analysis of Late Cenozoic Landforms (3rd Edition)

7. Lilleasand, T.M. and Kiffer, R.W., 1987. Remote Sensing and Image Interpretation. John Wiley.
8. Pandey, S.N., 1987. Principles and Application of Photogeology. Wiley Eastern, New Delhi.
9. Sabbins, F.F., 1985. Remote Sensing – Principles and Applications. Freeman.

## SKILL ENHANCEMENT COURSE

### BGLS 602

#### PhotoGeology and Remote Sensing

**Unit-I:** Elementary idea about photo geology: electro-magnetic spectrum, types & geometry of aerial photo graphs; factors affecting aerial photography; types of camera, film and filters; factors affecting scale;

**Unit-II:** 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-III:** Types of Indian and Foreign Remote Sensing Satellites, Digital image processing; fundamental steps in image processing; elements of pattern recognition and image classification.

**Unit-IV:** 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 andGIS.Oxford,NewDelhi.
2. Gupta, R.P.,1990. Remote Sensing Geology. Springer Verlag.
3. Lilleasand, T.M. andKiffer,R.W.,1987. Remote Sensing and Image Interpretation.JohnWiley.
4. Pandey, S.N.,1987.Principles and Application ofPhotogeology.WileyEastern,New Delhi.
5. Sabbins,F.F.,1985.Remote Sensing – Principles and Applications .Freeman.
6. Siegal, B.S. and Gillespie,A.R.,1980. Remote Sensingin Geology.John Wiley.
- 7.Rampal K.K.1999. Hand book of aerial photography and interpretation. Conceptpublication.

### BGLS302

#### Geomorphology and Geotectonics

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

**Unit-II:** Epigene/exogenic processes: degradation and aggradation. Diastrophism and volcanism, Geological work of wind, glacier, river, underground water and ocean.

**Unit-III:** Earthasadynamicsystem.Elementaryideaofcontinentaldrift,sea-floorspreading and mid-oceanic ridges. Paleomagnetism and its application, isostasy.

**Unit-IV:**Plate Tectonics: the concept, plate margins,,deep seatrenches,islandarcsand volcanic arcs, orogeny and rift valley.

**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).
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. Summerfield, M.A., 2000. Geomorphology and Global tectonic. Springer Verlag.
8. Valdia, K.S., 1988. Dynamic Himalaya. Universities Press, Hyderabad.
9. W.D. Thornbury, 2002. Principles of Geomorphology. CBS Publ. New Delhi





