SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

SYLLABUS FOR

Master of Geology

School of Basic & Applied Sciences

(w.e.f. 2021-2022)

Patel Nagar, Dehradun, Uttarakhand

Master of Geology

Programme outcome (POs)

PO 1	To provide an in-depth knowledge and skills in the field of Earth sciences to the students and research methods through laboratory, field and online modes of learning.
PO2	Recognize the need for sustainable use of earth resources, and value the environmental, indigenous and other community perspective on geological activities.
PO3	To understand and apply geological knowledge student will be capable appreciating the existence and exploration of natural resource system.
PO4	Apply the knowledge of geology makes the students fully competent to undertake any job in the field of Geology.
PO5	Work effectively and professionally along with multidisciplinary teams and be able to manage and analyse ethical issues.
PO6	To develop an interest for the student to take up higher studies in field of earth sciences.
PO7	Ability to recognize, evaluates, interpret, and understand issues and opportunities at the frontiers of geological domain.
PO8	To understand and communicate geological information concisely and accurately using written, visual, and verbal means appropriate to the situation.

Program Specific Outcome (PSOs)

PSO1	To gain the knowledge of essential properties of earth components, including its core, mantle, asthenosphere, lithosphere, cryosphere, hydrosphere, atmosphere and biosphere.
PSO2	To understand the geomorphic process, structural & tectonics problems, petrological process, mineralogical and their properties & crystallographic orientation, chronological arrangement of rocks, economic mineral deposits, geophysical & mining methods, ore deposits and their occurrences, geohydrological problems and environmental issues etc.
PSO3	Acquiring geologic data in the field, laboratory, satellites and big data from data banks, Analysing and interpreting the acquired data through application of scientific method.
PSO4	Apply knowledge and techniques from allied fields, including chemistry, physics, biology, mathematics, and computing, to solve geological problems.
PSO5	Students take-up a geologic problem and utilize theoretical, analytical or experimental approach to solve the problem through their project work.

Eligibility for admission:

B.Sc. with 45% and 40% in case of SC/ST categories with Geology as one of the subject

Duration of the Programme: 2 Year

STUDY & EVALUATION SCHEME
Choice Based Credit System
Master of Geology

First Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	MGLC101	General Geology and Geomorphology	4			4	40	60	100
2	Core	MGLC102	Structural Geology	4			4	40	60	100
3	Core	MGLC103	Mineralogy	4			4	40	60	100
4	Core	MGLC104	General and Invertebrate Paleontology	4			4	40	60	100
Practical										
1	Practical	MGLL105	Lab Course-I based on C101&C102			3	3	40	60	100
2	Practical	MGLL106	Lab course-II based on C103&C104			3	3	40	60	100
			Total				22			

Second Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	MGLC201	Crystallography	4			4	40	60	100
2	Core	MGLC202	Geotectonics	4			4	40	60	100
3	Core	MGLC203	Micropaleontology, Vertebrate Paleontology and Paleobotany	4			4	40	60	100
4	Core	MGLC204	Stratigraphy	4			4	40	60	100

5	Core	MGLC205	Geological Field Training Tour				3	40	60	100
6										
Practical										
1	Practical	MGLL206	Lab Course I based on C201 to C204			3	3	40	60	100
2										
			Total				22	240	360	600

Third Semester

S. No.	**Course Category**	**Couse Code**	**Course Name**	**Periods**				**Evaluation scheme**		**Subject Total**
				L	**T**	**P**	**C**	**Sessional (Internal)**	**External (ESE)**	
Theory										
1	Core	MGLC301	Igneous Petrology & Geochemistry	4			4	40	60	100
2	Core	MGLC302	Engineering Geology	4			4	40	60	100
3	Elective	MGLE304	Sedimentary and Metamorphic Petrology	4			4	40	60	100
4	Elective	MGLE305	Mineral exploration and Mining Geology	4			4	40	60	100
5	*Self-Study	MGLS307	Petroleum Geology	4			4	40	60	100
	*Self-Study	MGLS308	Environment Geology	4			4	40	60	100
Practical										
1	Practical	MGLL303	Lab Course based on C301&C302			3	3	40	60	100
2	Practical	MGLL306	Lab Course based on C304&C305			3	3	40	60	100
			Total				22	240	360	600

***Excluding self-study credit.**

Fourth Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	MGLC401	Geohydrology	4			4	40	60	100
2	Core	MGLC402	Ore Genesis and Indian Mineral Deposits	4			4	40	60	100
3	Elective	MGLE404	Geological Field Training Tour				3	40	60	100
4	Elective	MGLE405	Project/Dissertation				6	40	160	200
5										
6										
Practical										
1	Practical	MGLL403	Lab course based on C401&C402			3	3	40	60	100
2										
			Total				20	240	360	600

Examination Scheme:

Components	Ist internal	IInd Internal	Presentation/ Assignment/ Project	External (ESE)
Weightage (%)	Marks	Marks	Marks	Marks

M.Sc. Geology

1st Semester

Course code	**: MGLC101**			
Course Name	**: General Geology and Geomorphology**			
Semester /Year	**: 1st**			
L	**T**	**P**	**C**	
4			**4**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The course "Earth Surface Processes" is intended to provide a holistic approach to study the surficial features and the processes with emphasis on links and feedbacks between its components.

2. The subject will serve as a dynamic and physical based account of the processes at planet's surface with an integrated approach involving the principles of geomorphology

3. The course will provide opportunity to the students learn morphometric techniques in general and in the case of a drainage basin in particular

Course Content: (Total Hrs.-40)

Unit 1:- Basic concepts and Application of geomorphology in Applied Geomorphology and Palaeo-geomorphology. (8Hrs.)
Unit 2:- Elementary idea of cosmogeny, Interior of earth, geochronology, theories of isostasy, ocean bottom topography cycle of erosion, landscape evolution, rock weathering, soil formation and classification of soils. (8Hrs.)
Unit 3:- Geosynclines, their classification and evolution, orogeny and epeiorogeny, volcanoes, earthquakes, island arcs, rift valleys and grabens. (8Hrs.)
Unit 4:- Glacial, Aeolian, fluvial and costal landscapes of India, karst topography, landforms of Himalayas. (6Hrs.)
Unit 5:- Drainage development and slope morphometry, quaternary geomorphology, geomorphology and geomorphic hazards of Uttarakhand. (10Hrs.)

Text Books:

TB1. Savindra singh , geomorphology, pravalika pub. Allahabad.
TB2. Thornbury, W.D. (1980): Principle of Geomorphology, Wiley Eastern Ltd. New York.
TB3. Sharma, H.S. (1990): Indian Geomorphology, Concept Publishing Co. New Delhi.

TB4. Agrawal, L. C. Introduction to Geomorphology

Reference Books:

RB1. Holmes, A. (1992): Holmes Principles of Physical Geology, Chapman & Hall publ.
RB2. Condie, Kent. C. (1982): Plate Tectonics & Crustal Evolution, Pergamon Press.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge about the Earth's Energy Balance, Hydrological cycle, Topography and bathymetry. Learning about the sedimentary flux: origin, transport and deposition.
CO2	To understand about the geomorphic and sedimentological processes related to fluvial, coastal, aeolian, and glacial regimes.
CO3	To understand about the environmental changes and its impact on surface processes and landforms.
CO4	To analyse about the drainage development and geomorphic hazards**.**
CO5	To understand the usefulness of morphometric techniques in the case of a drainage basin.
CO6	To understand the relevance of applied aspects of Geomorphology in various fields.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1
CO6	2	1	3	2	2	1	1	1	2	3	1	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC102**			
Course Name	**: Structural Geology**			
Semester /Year	**: 1st**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The present course will teach the student how to unravel the underlying deformation processes and mechanisms through an accurate geometric and kinematic analysis of these natural structures.

2. The present course will teach the dynamic instability of the lithosphere, continuous and discontinuous deformation takes place within the rocks in solid or semi-solid state, at different scales, which manifests in a variety of complex structures in these rocks.

Course Content: (Total Hrs.-40)

Unit 1:-Definition and scope of structural geology, properties of rocks and factors affecting the behavior of rocks. (5Hrs.)
Unit 2:-Theory of stress and strain, kinematic analysis, Mohr's Circles, strain and stress ellipsoids. Strain marker and Measurement of strain in deformed rocks. (9Hrs.)
Unit 3:- Geometry and Classification of fold & Mechanics of folding and buckling, Flexure fold; flexural slip folds, flexural flow folds, passive folds and distribution of strains in folds. (9Hrs.)
Unit 4:- Geometry and Causes and dynamics of faulting: Strike-slip Faults, Normal Faults, Thrust Faults; joints, foliations, unconformities, Mylonites and Cataclastics. (9Hrs.)
Unit 5:-Basic idea about petrofabrics and use of Universal stage, diapers and salt domes, cleavage, lineation. (8Hrs.)

Text Books:

TB1. Ghosh, S. K.: Structural Geology, Fundamental and Modern Concepts, Pergamon Press.
TB2. Ramsay J. G. (1967): Folding and fracturing of Rocks, McGraw Hill Pub.
TB3. Ramsay J.G. & Huber M. I. (1983): The Techniques of Modern Structural Geology-I, Strain Analysis, Academic Press.

Reference Books:

RB1.Turner, F.J. & Weiss, L.E. (1963): Structural analysis of Metamorphic Tectonites, McGraw Hill publ.
RB2. Jain, A,K , advance structural analysis, Nem chand and bros

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge and accurate geometric description of the structures observed in natural deformed rocks.
CO2	To understand and measurement of various orientation data from the structures, plotting them in suitable diagrams and make a quantitative analysis.
CO3	To understand the basic concepts of the rheological properties of rocks and their control on the deformation processes.
CO4	Understanding deformation mechanisms at micro-, meso and macroscopic scales

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code : MGLC103				
Course Name : Mineralogy				
Semester /Year : 1st				
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The present course will teach the characteristics of major rock forming mineral groups, crystal symmetry, and crystallography axis.
2. The present course will teach the atomic structure, formation environments and associations of rock-forming minerals.

3. The present course will teach the techniques of mineral characterization.

Course Content: (Total Hrs.-40)

Unit 1:- structures and types of atoms, types of chemical bonding, chemical properties of minerals. (8 Hrs.)
Unit 2:- Structures and classification of Silicates, Physical properties of minerals. (10Hrs.)
Unit 3:- A detail study of important silicates with reference to general and structure formulae, classification, atomic structures, chemistry including substitution of element and mode of occurrence. (12Hrs.)

a) Neosilicates/orthosilicates: olivine group and Garnet group.

b) Sorosilicate: melilite group

c) Cyclosilicate: beryl
d) Inosilicate: pyroxene and amphibole group.

e) Phyllosilicate: kaolinite group.

f) Tectosilicate: feldspar group.

g) quartz and non-silicate: carbonate, oxide , sulphide.

Unit 4:- Properties of uniaxial and biaxial crystal. (8Hrs.)

Text Books:

TB1. Moor house, W.W.: Optical Mineralogy.
TB2. Dana, E.S. & Ford, W.E.: A Text book of Mineralogy, Wiley Eastern Ltd.
TB3. Phillips, W.R & Guffen, D.T- Optical mineralogy.
TB4. Barry & Mason- Mineralogy.

Reference Books:

RB1. Dexter perkin,optical mineralogy
RB2. Alexander N. winchill ,element of optical mineralogy, ulan press pub.
RB3. Babu .S.K and sinha.D.K , mineralogy ,CBS pub

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge and identify common rock-forming minerals in hand specimen and in thin section using diagnostic physical, optical, and chemical properties
CO2	To understand about crystallography and to infer the environment of formation of minerals.
CO3	To understand the minerals as a tool to understand Earth processes, Earth's Interior and Earth history.
CO4	Understanding of basic techniques of mineral characterization.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC104**			
Course Name	**: General and Invertebrate Paleontology**			
Semester /Year	**: 1st**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Making students understand the evolution of life in geological past is an important aspect of geology. Palaeontology, the study of fossils includes the study of vertebrate and invertebrate fossils, micro-fossils, plant fossils, trace fossils their evolution and distribution in time and space. These aspects are fundamental not only to geology and stratigraphy but inter-disciplinary fields of botany, zoology and branches of science.

2. The study of Palaeontology encompasses the aspects of appearance, evolution and extinction of life through the geologic time. The knowledge of palaeontology would enable the students to understand the biological changes that occurred in the history of the earth and relate them with their field observations.

3. The students will acquire skills of describing fossils and their taxonomic classification. They will also be introduced to the application of palaeontology and the use of fossils in hydrocarbon exploration, establishing biostratigraphy, inferring paleoecology, paleobiogeography of the geological past.

Course Content: (Total Hrs.-40)

Unit 1:-Modern Taxonomy, Identification of fossils, collection of fossils, types of fossils, and mode of preservation, uses of fossils. (8Hrs.)

Unit 2:-Biostratigraphy, Paleoecology, origin of life and organic evolution. (8Hrs.)

Unit 3:-Early Precambrian life, Ediacaran fossil assemblage and organo-sedimentary structures. (8Hrs.)

Unit 4:-Classification, Morphology, Evolutionary trend and geological history of major invertebrate group: Mollusca (Bivalve, Gastropoda and Cephalopoda), Brachipoda, Arthopoda, Echinoidea and Graptolite. (8Hrs.)

Unit 5:-Zoogeographic provenance, dispersal and extinction. (8Hrs.)

Text Books:

TB1. Jain, P.C.&Anantharaman, M.S., 1983.Paleontology: Evolution& Animal Distribution. Vishal
TB2. Clarkson, E. N.K. (1998): Invertebrate Paleontology and Evolution.
TB3. Smith, A.B. (1994): Systematic and fossil record- Documenting Evolutionary patterns.

Reference Books:

RB1. Henry woods, invertebrate paleontology,
RB2. Shrock and twen hofel, principle of invertebrate paleontology

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Students will be able to gain the knowledge of document field observations and collection of fossils and process fossils in the lab.
CO2	Students will be able to understand field and lab methods common in paleontology to collect and document fossils and data in the field and to analyze collected samples and data to solve a problem.
CO3	Students will be able to estimate the approximate age of a sequence of rocks from the assemblage of fossils present.
CO4	Students will be able to determine evolutionary relationships among a set of organisms.
CO5	Students will be able to interpret the modes of life of fossil organisms.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLL105**			
Course Name	**: Lab Course based on C101&C102**			
Semester /Year	**: 1st**			
L	**T**	**P**	**C**	
		3	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The main objective of this course is to understand geomorphological features from various morphogenetic regions of India.

2. To understand the morphometry of drainage basins, analysis of orientation structures.

3. To understand the structural problems, Preparation and interpretation of geological maps and sections.

Course Content: (6Hrs./Week)

Unit1-General Geology and Geomorphology

- Analysis of geomorphological features from various morphogenetic regions of India; preparation of geomorphological maps on different scales (1:25,000, 50,000 & 1:50,000).
- Preparation of longitudinal and cross valley profiles.
- Altimetric analysis, hypsometric analysis, exercises related to measurements of run off dynamics, sediment and solute dynamics.
- Morphometry of drainage basins, analysis of orientation structures.

Unit2-Structural Geology

- Preparation and interpretation of geological maps and sections.
- Structural problems.

Text Books:

TB1. Guhey Rajeev, Geology: Principles and Practical Manual, New India Publishing Agency-Nipa

TB2. Practical Approach to Crystallography and Mineralogy 2Nd Edition 2017 by Hota, CBS Publishers and Distributors

Reference Books:

RB1. Guhey Rajeev, Geology: Principles and Practical Manual, New India Publishing Agency-Nipa

RB2. Practical Approach to Crystallography and Mineralogy 2Nd Edition 2017 by Hota, CBS Publishers and Distributors

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To analysis of geomorphological features from various morphogenetic regions of India; preparation of geomorphological maps on different scales (1:25,000, 50,000 & 1:50,000). Preparation of longitudinal and cross valley profiles.
CO2	Altimetric analysis, hypsometric analysis, exercises related to measurements of runoff dynamics, sediment and solute dynamics. Morphometry of drainage basins, analysis of orientation structures.
CO3	To understand and preparation and interpretation of geological maps and sections. Structural problems.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2

M.Sc. Geology

Course code : MGLL106				
Course Name : Lab Course based on C103&C104				
Semester /Year : 1st				
	L	**T**	**P**	**C**
			3	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. This course provides the knowledge and identifies common rock-forming minerals in hand specimen and in thin section using diagnostic physical, optical, and chemical properties.

2. This course provides the knowledge of invertebrate fossils record and students will be able to interpret the modes of life of fossil organisms

Course Content: (6Hrs./Week)

Unit1-Mineralogy

- Study of minerals in hand specimen
- Microscopic study of rock forming minerals.

Unit2-General& Invertebrate Paleontology

- Study of important invertebrate fossil belonging to brachiopoda, bivalve, gastropoda, cephalopoda, trilobita and echinods.

Text Books:

TB1. Guhey Rajeev, Geology: Principles and Practical Manual, New India Publishing Agency-Nipa

TB2. The Practical Geologist: The Introductory Guide to the Basics of Geology and to Collecting and Identifying Rocks Dixon, Dougal, Publisher Touchstone

Reference Books:

RB1. Guhey Rajeev, Geology: Principles and Practical Manual, New India Publishing Agency-Nipa

RB2. The Practical Geologist: The Introductory Guide to the Basics of Geology and to Collecting and Identifying Rocks Dixon, Dougal, Publisher Touchstone

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge and study of minerals in hand specimen Microscopic study of rock forming minerals.
CO2	To understand the mineral properties, nature and evolution under the microscope
CO3	To gain the knowledge and study of important invertebrate fossil belonging to brachiopoda, bivalve, gastropoda, cephalopoda, trilobita and echinods.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2

M.Sc. Geology

2nd Semester

Course code : MGLC201				
Course Name : Crystallography				
Semester /Year : 2nd				
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The objective of this course is to present the basic concepts needed to understand the crystal structure of materials. Fundamental concepts including lattices, symmetries, point groups, and space groups will be discussed and the relationship between crystal symmetries and physical properties will be addressed.

2. The theory of X-ray diffraction by crystalline matter along with the experimental x-ray methods used to determine the crystal structure of materials will be covered.

3. Application of X-ray diffraction to proteins, electron diffraction and neutron diffraction will be briefly discussed.

Course Content: (Total Hrs.-40)

Unit 1:-Introduction to space group, space lattices, lattice defects, symmetry elements. (8Hrs.)

Unit 2:-Historical development of X-ray crystallography, Bragg equation, goniometer. (8Hrs.)

Unit 3:-Description of normal classes and important sub-classes. (8Hrs.)

Unit 4:-Different type of crystal projection and crystal imperfections. (8Hrs.)

Unit 5:-Twinning and twinning laws – common types of twins and their examples. (8Hrs.)

Text Books:

TB1. Dana, mineralogy
TB2. Perkinson. D, mineralogy

Reference Books:

RB1. Wahlstrom-optical crystallography.
RB2. Sands, D.E. (1975): An Introduction to Crystallography, W.A. Benjamine Inc., N.Y.
RB3. Phillips, F.C.: Introduction to Crystallography.
RB4. Evans, R.C. (1964): Introduction to Crystal Chemistry, Cambridge Uni. Press.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To understand the concepts such as lattice, point and space groups.
CO2	To gain the knowledge of Bragg's Law and explain it's the relation to crystal structure.
CO3	To understand the Identification and describe different diffraction methods.
CO4	To analyses and interpret and assign X-ray and electron diffraction patterns.
CO5	To understand the basic concept of twinning and its application.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC202**			
Course Name	**: Geotectonics**			
Semester /Year	**: 2nd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The objective of this course is to understand the basic concept of continental drift and supporting evidences, Geomagnetic fields, palaeomagnatism, polar wander, geomagnetic pole reversal, sea floor spreading .

2. The objective of this course is to understand the basic concept of Plate boundaries, plate motion and dynamics.

3. The objective of this course is to understand the basic concept of Relative plate motion -geodetic measurement, seismology, internal structure of the earth and to understand the geodynamics of Indian plate and evolution of Himalayas

Course Content: (Total Hrs.-40)

Unit 1:-Evidence of continental drift, mechanics, objections and present status, Concept of Plate Tectonics. (10Hrs.)

Unit 2:- Major tectonic features of the oceanic and continental crust, island arcs, oceanic islands and volcanic arcs, Gravity and magnetic anomalies at mid oceanic ridges, Origin and significance of Mid-Oceanic Ridges and Trenches. (8Hrs.)

Unit 3:- Seismic belts of the earth & seismicity and mountain chains, their global distribution and evolution. (6Hrs.)

Unit 4:- Sea floor spreading, Palaeo-magnetism, Polar Wandering and reversal of earth's magnetic field. (8Hrs.)

Unit 5:- Origin of Himalaya, Tectonic history of India & geodynamics of Indian plate. (8Hrs.)

Text Books:

TB1. Condie Kent, C. (1989): Plate Tectonics and Crustal Evolution.
TB2. W. J. Kious & Robert I.T.: This dynamic of Earth: the story of Plate Tectonics USGS publ.
TB3. Moores, E. & Twiss, R.J., 1995: Tectonics. Freeman publ.

Reference Books:

RB1. Keary, P. & Vine, F.J. 1990: Global Tectonics. Blackwell scientific publ.
RB2. Storetvedt, K.N. 1997: Our Evolving Planet. Earth History in new perspective.
RB3. Valdiya, K.S. 1998: Dynamics Himalaya. Univ. Press.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge of the dynamic nature of the Earth processes,
CO2	To understand about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics.
CO3	To understand present geophysical and geological evidence for the processes operating in modern tectonic systems.
CO4	To analyse assess and reconstruct the components of ancient tectonic systems.
CO5	To Understand quantify and critically evaluate the nature of regional deformation from a variety of tectonic systems.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC203**			
Course Name	**:** Micropaleontology, Vertebrate Paleontology and Paleobotany			
Semester /Year	**: 2nd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. This course covers basically the evolution of vertebrates from basal fishes to hominids.

2. The main objective of the course is to impart knowledge on diversity, evolution, and interrelationships among vertebrates.

3. It is also aimed at providing insights into current debates on vertebrate paleobiology and geological and biological processes responsible for vertebrate evolution.

Course Content: (Total Hrs.-40)

Unit 1:-Microfossils; types of microfossils and its Importance, Collection and preparation of microfossils. (6Hrs.)
Unit 2:- Micro-paleontology: morphology, Palaeo-ecology and geological distribution of foraminifera, conodonts, ostracodes, radiolaria and diatoms. (10Hrs.)
Unit 3:- Vertebrate life through ages and landmarks in their evolution, evolutionary trends in man, horse and elephant. (10Hrs.)
Unit 4:- Palaeobotany: Morphology, distribution and significance of Gondwana flora. (8Hrs.)

Unit 5:- Palynology: Morphology and significance of pollen and spores. (6Hrs.)

Text Books:

TB1. Romer, A.S. 1966. Vertebrate Paleontology, Chicago Univ. Press.
TB2. Swinnerton, H.H. (1950) An outline of palaeontology.
TB3. Arnold, C.A. (1947) An Introduction to palaeobotany, Mc Graw Hill.

Reference Books:

RB1. Armstrong, H. & Brasier M. (2005): Micro fossils. Black Well pub.
RB2. Colbert, E.H.(1984) Evolution of the vertebrates. Willey Eastern Ltd.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain knowledge of the main systematic groups of vertebrate, microfossils, its distribution and (Palaeo) environmental and (Palaeo) climatic meaning.
CO2	To understand the skills development on methods and techniques of biostratigraphy and paleobiology, applied to the microfossils.
CO3	To understand and to Collect, organize and analyse descriptive data of microfossils and associated sedimentary materials using adequate concepts, methodologies.
CO4	To understand the knowledge of Palynology: Morphology and significance of pollen and spores.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC204**			
Course Name	**: Stratigraphy**			
Semester /Year	**: 2nd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The course is intended to familiarize the student with stratigraphic principles and nomenclature, major stratigraphic units, methods of stratigraphic correlation, depositional environments and tectonostratigraphic framework of various lithostratigraphic units of India spanning Archaean to Holocene, and mass extinction boundaries.

Course Content: (Total Hrs.-40)

Unit 1:-Principle of Stratigraphy & Geological time scale, stratigraphic correlation, nomenclature of modern stratigraphic code, Walther's Law, Basic principles of seismic stratigraphy, sequence Stratigraphy and magneto stratigraphy. (8Hrs.)

Unit 2:- Archean and Precambrian stratigraphy of peninsular India. (8Hrs.)
Unit 3:- Phanerozoic stratigraphy of Peninsular India. (8Hrs.)
Unit 4:- Precambrian and Phanerozoic stratigraphy of Himalaya and Indo-Gangetic Plain. (8Hrs.)
Unit 5:- Precambrian-Cambrian, Permian-Triassic, Cretaceous- Tertiary boundaries (with Indian examples), Reconstruction of paleogeography and palaeoclimates (8Hrs.)

Text Books:

TB1. Naqvi, S.M. & Rogers, J.J.W. (1987): Precambrian Geology of India, Oxford Univ. Press.
TB2. Schoch, Robert, M. (1989): Stratigraphy-Principles and Methods, Van Nostrand Reinhold, New York.

TB3. Kumar, R. (1984): Fundamentals of Historical Geology & Stratigraphy of India.
TB4. Krishnan, M.S. (1982): Geology of India and Burma, C.B.S. Publishers & Distributors, Delhi.
TB5. Valdiya, K.S. (2009): The Making Of India: Geodynamic Evolution. Macmillan Publishers India

TB6. Ramakrishnan M. and Vaidyanadhan,(2008 &2010) Geology of India (Vol. 1 & 2), GSI pub.

Reference Books:

RB1. Dunbar, C.O. & Rodgers, J. (1957): Principles of Stratigraphy, John Wiley & Sons.
RB2. Krumbein, W. C. & Sloss, L.L. (1963): Stratigraphy and sedimentation.
RB3. Freeman, W. H. & Kummel, Co. (1961): History of the earth.
RB4. Hollis D. Hedbug (Ed.) International stratigraphic guide - International sub commission on
RB5. startigraphic classification of IUGS commission on stratigraphy John Wiley and Sons

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To understand basic principles of stratigraphy, different types of stratigraphy & stratigraphic units and how they are named.
CO2	To gain the Knowledge of the crustal evolution during the Precambrian in peninsular India and how the biosphere responded to the Precambrian-Cambrian boundary events.
CO3	To understand how plate tectonic movements separated India from contiguous landmasses and shaped the depositional basins of the Indian Phanerozoic, and what were their effects on climate and life.
CO4	To understand and learn about large igneous activities and their role in mass extinction events and important mass extinction boundary sections.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code : MGLC205				
Course Name : Geological Field Training Tour				
Semester /Year : 2nd				
	L	**T**	**P**	**C**
				3

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Geological field work is important to understand rocks in their natural environment and their natural relationship to one another.

2. It seeks to describe and explain the surface feature and underground structure of the lithosphere based upon observations and inferences.

Course Content:

Students will be required to visit geologically important areas including mines, dams, oil fields, fossiliferous sequences and laboratories/institutes of repute and submit a report thereon, under the supervision of a faculty member. Geological field mapping and 3 days tour.

Text Books:

TB1. Mathur S.M., Guide To Field Geology

TB2. Gokhale N.W., A Guide to Field Geology

Reference Books:

RB1. Mathur S.M., Guide To Field Geology
RB2. Gokhale N.W., A Guide to Field Geology

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	The course is intended to expose students to any economic deposit, familiarize them about host rock and economic mineral relationship, variable geometry of ore bodies.
CO2	To understand the planning of exploration and exploitation, Open and/or underground mine section.
CO3	To understand how to identify the structures and microstructures.
CO4	To understand the fundamentals work on the field.
CO5	To gain the knowledge and develop skills for the writing of the tour report.

M.Sc. Geology

Course code	**: MGLL206**			
Course Name	**: Lab Course based on C201 to C204**			
Semester /Year	**: 2nd**			
L	**T**	**P**	**C**	
		3	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. This course will provides the basic knowledge of crystal and learn how the orientation of, axis of symmetry, plane of symmetry and centre of symmetry by using the crystal model.

2. This course will provide the basic understanding of stereographic projection by using the filed data.

3. Study morphology and age of the vertebrate fossils with hand specimen and micro-organism by using the microscope. Study about the chronology of the rocks.

Course Content: (6Hrs./Week)

Unit1- Crystallography

- Crystal model and projection

Unit2- Geotectonics

- Stereographic presentation of structural data

Unit3- Micropaleontology, vertebrate paleontology and Palaeobotany

- Study of important Microfossils,
- Study of Vertebrate fossils and Gondwana Flora

Unit4- Stratigraphy

- Study of paleo-geographic maps of Precambrian and Phanerozoic
- Chronological study of important rocks

Text Books:

TB1. Guhey Rajeev, Geology: Principles and Practical Manual, New India Publishing Agency-Nipa

TB2. Practical Approach to Crystallography and Mineralogy 2Nd Edition 2017 by Hota, CBS Publishers and Distributors

Reference Books:

RB1. Guhey Rajeev, Geology: Principles and Practical Manual, New India Publishing Agency-Nipa

RB2. Practical Approach to Crystallography and Mineralogy 2Nd Edition 2017 by Hota, CBS Publishers and Distributors

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge of Crystal model and projection Stereographic presentation of structural data
CO2	To understand and study of important Microfossils, Study of Vertebrate fossils and Gondwana Flora
CO3	To understand and study of paleo-geographic maps of Precambrian and Phanerozoic Chronological study of important rocks

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2

M.Sc. Geology

3rd Semester

Course code	**: MGLC301**			
Course Name	**: Igneous Petrology and Geochemistry**			
Semester /Year	**: 3rd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. This is an introductory course to provide a basic understanding of the different groups of igneous rocks and the processes involved in their formation.

2. This course starts with the chemistry and physics of melts and their behaviour under varying temperature and pressure conditions, and goes on to discuss the different kinds of igneous rocks and rock suites that form under different tectonic conditions.

3. The focus broadens to the formation of the solar system, the Earth, and the elements themselves. Then the composition of the Earth itself becomes the topic, examining the composition of the core, the mantle, and the crust and exploring how this structure originated.

Course Content: (Total Hrs.-40)

Unit 1:-Magmatic processes: fractional crystallization, magma mixing, crystal setting, liquid immiscibility, assimilation, differentiation, and effects, magmatic crystallization – Bowens reaction principle. (10Hrs.)

Unit 2:-Gibbs phase rule – definition of phase, component and degree of freedom, application of Phase rule in bi-component and tri component magma. The Phase equilibrium of binary (Ab-An, Ab-Or, Di-An), ternary magma (An-Al-Di system and An- Di – Fo, system). (8Hrs.)

Unit 3:-Texture and structures, IUGS classification of the volcanic and plutonic Igneous rocks, and ophiolite (8Hrs.)

Unit 4:-Petrogenesis and petrography of the following rocks:- Aplite, Anorthosite, Andesite, Basalt, Carbonatite, Charnockite, Diorite, Dunite, Dolerite, Gabbro, Granite, Granodiorite, Kimberlite, Komatiite, Lamprophyre, Pegmatite, Peridotite, Syenite, Trachyte. (8Hrs.)

Unit 5:-Introduction of Geochemistry, Chemical composition and properties of Earth's layers. Atmosphere: its layers, chemical composition and chemistry of Atmosphere and hydrosphere, geochemical classification of elements, meteorite and their classification. (6Hrs.)

Text Books:

TB1. Gupta, A.K. (1998): Igneous Rocks Allied Publishers Ltd., New Delhi.
TB2. Jackson: Textbook of lithology.
TB3. Winter, J.D. (2001): An Introduction to Igneous and Metamorphic Petrology
TB4. McBirney, A.R. (1984): Igneous Petrology, Freeman Cooper & Co. California.
TB5. Phillpots A.: Introduction to igneous and metamorphic petrology, Prentice Hall Pub.

Reference Books:

RB1. Turner, F.J. & Verhoogen, J.: Igneous & Metamorphic petrology CBS Publications.
RB2. Bose, M.K. (1997): Igneous Petrology, World Press, Kolkatta.
RB3. Best, Myron G. (2002): Igneous and Metamorphic Petrology, Blackwell Science.
RB4. Mason , geochemistry
RB5. Krauskopf, geochemistry

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge, igneous rocks is a key component of geology curriculum (because these rocks not only abundant throughout the Earth's crust, but, also predominate upper mantle environment)
CO2	To understand of the processes leading to their genesis.
CO3	To understand the phase relationships in simple phase diagrams & differences between open and closed systems.
CO4	To understand the physical process of magma formation by partial melting of the mantle,magmatic differentiation, mixing and contamination changing magmatic melts on their way to the surface.
CO5	To understand the petrological and geochemical characteristics of different plate tectonic environment.
CO6	To understand the cosmic abundance of elements, meteorite and the composition of atmosphere, hydrosphere and Earth.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1
CO6	2	1	3	2	2	1	1	1	2	3	1	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC302**			
Course Name	**: Engineering Geology**			
Semester /Year	**: 3rd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. In order to construct a safe, long lasting and profitable benefit cost ratio structure the application of geological knowledge is very much in demand.

2. The subject owes its growth to many civil structures which failed due to lack of geological application in the past. Therefore, study of engineering geology is required.

Course Content: (Total Hrs.-40)

Unit 1:-Role of Engineering geology in civil construction and mining industry; Engineering properties of rocks ;physical characters of building stones, concrete and other aggregates. (8Hrs.)

Unit 2:-Geological considering for evaluation of dam and reservoir site. (8Hrs.)

Unit 3:-Geotechnical investigation of tunnels – type, methods and problems and road. (8Hrs.)

Unit 4:-Landslides – classification, causes and preventive methods. (8Hrs.)

Unit 5:-Bridges – types and foundation problems influence of geological conditions on foundation and design of buildings. (8Hrs.)

Text Books:

TB1. Krynine D. P. & Judd W. R. (1998): Principles of engineering geology & geo-techniques.
TB2. Gupta, H. K. & Rastogi, B. K. (1976): Dams and Earthquakes, Elsevier and Scientific Pub. Co.
TB3. Clarke: Reservoir engineering.

Reference Books:

RB1. Bell, F. G. (1983): Fundamentals of engineering geology, Butterworth's, London.
RB2. Schuttz, J.R and Cleaves , A.B.(1951) Geology in Engineering, John Willey and Sons, New York.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge about the selection of most suitable sites for any civil structure, over or underground.
CO2	To understand the selection of suitable construction materials for any such project work (e.g:-Dam, Tunnel etc.)
CO3	To understand ensuring that the structure will last long and serve the purpose for which it has been built.
CO4	To understand the eventually leading the way for infrastructural development for the country.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated.

M.Sc. Geology

Course code	**: MGLE304**			
Course Name	**: Sedimentary and Metamorphic Petrology**			
Semester /Year	**: 3rd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The purpose of this course is to give you a broad understanding of how sedimentary rocks form and how they evolve as they undergo burial. This starts with understanding sediment composition and how this can be used to infer source area characteristics.

2. We will study how, beginning soon after deposition, sediments become lithified. This includes both chemical and physical transformations that lead to major changes in the original petro physical (porosity and permeability) characteristics of sediments and sedimentary rocks as lithification and diagenesis occur

3. The study of metamorphic rocks encompass the chemical and physical transformations that take place in response to changing pressure, temperature, and chemical environments in the Earth's interior. In this course, different petrogenetic processes involving mineral reactions will be explored using equilibrium thermodynamics.

Course Content: (Total Hrs.-40)

Unit 1:-Origin of Terrigenous Clastic and Non-Clastic grains; weathering and its products, structure, texture of sedimentary rocks. (8Hrs.)
Unit 2:- Petrography and a digenesis origin of sandstone, limestone, shale, mudstone, Arkose, breccia. (6Hrs.)
Unit 3:- Sedimentary facies, depositional environments, provenance and Palaeo-current. (8Hrs.)

Unit 4:- Factors controlling metamorphism; Texture and structures of metamorphic rocks. (6Hrs.)

Unit 5:-Metamorphic grades and Index minerals, types of metamorphism, law of thermodynamics and Gibbs Equation. (6Hrs.)
Unit 6:-Metamorphic Facies : Zeolite, Blue-schist, Green-schist - Amphibolite, Granulite, Eclogite and contact metamorphic facies. (8Hrs.)

Text Books:

TB1. Pettijohn, F. J. Sedimentary rocks (McGraw-Hill, New Delhi)
TB2. Blatt, H., Midleton, G and Murray, R., Origin of Sedimentary Rocks, Prentice Hall
TB3. Verma, V. K. And Prasad, C., Sedimentology (Harman Publishing House, New Delhi)
TB4 Collins,J.D., and Thompson,D.B.(1982):Sedimentary structures.George Allen and Unwin,London.
TB5 Pettijohn,F.J.(1975): Sedimentary Rocks.3rd Edn.Harperand Row Publ., New Delhi.

Reference Books:

RB1. Tucker,M.E.(1981): Sedimentary Petrology: An Introduction,Wiley & Sons,
RB2. Winter, J.D. (2001): An Introduction to Igneous and Metamorphic Petrology New York.
RB3. Bucher,k. and Martin,F.2002: Petrogenesis of Metamorphic Rocks, Springer-Verlag, 7th Revised Edition.
RB4. Yardley, B.W.D.1989: An Introduction to Metamorphic petrology, Longman scientific &Technical, New York.
RB5. Spry, A.1976: Metamorphic Texture, Pergamon Press.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge how sediments become sedimentary rocks, how porosity forms and evolves and how they can interpret the digenetic evolution of ancient sedimentary rocks.
CO2	To understand and learn the role weathering and sediments play in the global climate system, as well as how energy and other resources come from sedimentary rocks.
CO3	To understand the metamorphic textures and how they form.
CO4	To analyse how metamorphic textures vary with metamorphic grade; and
CO5	To understand, what metamorphic rocks are formed by each type of metamorphism when you start with different protolith rocks.
CO6	To understand the metamorphic facies diagram. Explain the pressure and temperature conditions and metamorphic facies and grades rocks would pass through during:

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1
CO6	2	1	3	2	2	1	1	1	2	3	1	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLE305**			
Course Name	**: Mineral Exploration and Mining Geology**			
Semester /Year	**: 3rd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Exploration is a range of activities to help determine if there are minerals under the ground. If the exploration process identifies minerals can be commercially extracted, then mining in the future may be possible. Less than one per cent of exploration projects typically progress to establishing a mine. Geology is the first step in mining and involves identifying prospective mineral deposits that might become mines. Geology also helps mine managers know where to develop once the mine is up and running.

Course Content: (Total Hrs.-40)

Unit 1:-Prospecting for economic minerals, sampling assaying and evaluation of mineral deposits, geological and geo-botanical techniques of prospecting. (8Hrs.)

Unit 2:-Gravity method: principle of gravimeters, gravity field surveys, various types of corrections applied to gravity data, Resistivity method: basic principles, various types of electrode configuration, field procedure: profiling and sounding and magnetic, seismic and radioactive methods. (12Hrs.)

Unit 3:-Brief outline of well-logging techniques and their methods, Drilling and type of drilling methods, Application of remote sensing in mineral exploration. (8Hrs.)

Unit 4:-Planning, exploration and exploratory mining of surface and underground mineral deposits involve shaft sinking, drifting, cross cutting, winzing, stoping, room and pillaring, top- slicing, sub caves and block caving. (8Hrs.)

Unit 5:-Cycles of surface and underground mining operations, coal mining and Mining hazards: mine inundation, fire and rock burst. (6Hrs.)

Text Books:

TB1. Sinha, R.K. & Sharma, N.L. (1976): Mineral Economics.
TB2. Arogyaswami, R.N.P. (1996): Courses in Mining Geology

Reference Books:

RB1. P.K. Banerjee and S. Ghosh (1997): Elements of prospecting for non-fuel mineral deposits.
RB2. Bagchi, T.C., Sengupta, D.K. & Rao, S.L.V.N. (1979): Elements of Prospecting and Exploration.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To understand the knowledge of selected ore deposit types, including genesis and exploration requirements.
CO2	Thorough understanding of non-seismic exploration techniques and applications.
CO3	To analyse the geological and geophysical data.
CO4	To understand the Geochemical & Geobotanical exploration methods and geochemical data presentation/analysis.
CO5	To understand the range of surface and underground mining techniques.
CO6	To understand the role of geology in mine design and operation.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1
CO6	2	1	3	2	2	1	1	1	2	3	1	2	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLL303**			
Course Name	**: Lab Course based on C301&C302**			
Semester /Year	**: 3rd**			
L	**T**	**P**	**C**	
		3	**3**	

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The aim of this course is to understand how igneous rocks are classified based on the mineralogy and textures and how these can be used to interpret their cooling history. Upon completion of this course, the student will be able to identify igneous rocks and explain the processes by which the rock formed based on the textural associations of the mineral assemblages.

2. The aim of this course is to understand how Interpret the geological maps for landslides, Tunnel, Dam etc., problems.

3. The aim of this course is to understand survey of plot using chain, prismatic compass and plane table survey.

Course Content: (6Hrs./Week)

Unit1-Igneous Petrology & Geo Chemistry

- Megascopic study of different types of igneous rocks.
- Microscopic study of important igneous rocks.
- Plotting of modal data is IUGS diagram.

Unit2- Engineering Geology

- Study of properties of common rocks with reference to their utility in engineering projects. Study of maps and models of important engineering structures, dam sites and tunnels. Interpretation of geological maps for landslides problems.
- Survey of a plot using Chain, Prismatic compass, Plane table, GPS data collection and plotting.

Text Books:

TB1. W.S. Mackenzie, C. Guilford, Atlas of the Rock-Forming Minerals in Thin Section

TB1. Engineering Geology Practicals 2Nd Edition 2018 by M T Maruthesha Reddy, New Age International (P) Ltd Publishers

TB2. Practical Handbook Of Earth Science by Jane H. Hodgkinson; Frank D. Stacey, CRC Press

Reference Books:

RB1. Engineering Geology Practicals 2Nd Edition 2018 by M T Maruthesha Reddy, New Age International (P) Ltd Publishers

RB2. Practical Handbook Of Earth Science by Jane H. Hodgkinson; Frank D. Stacey, CRC Press

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge of Megascopic study of different types of igneous rocks. Microscopic study of important igneous rocks. Plotting of modal data is IUGS diagram
CO2	To understand the properties of common rocks with reference to their utility in engineering projects. Study of maps and models of important engineering structures, dam sites and tunnels. Interpretation of geological maps for landslides problems.
CO3	To analyse the survey of a plot using Chain, Prismatic compass, Plane table, GPS data collection and plotting.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2

M.Sc. Geology

Course code : MGLL306				
Course Name : Lab Course based on E304&E305				
Semester /Year : 3rd				
	L	**T**	**P**	**C**
			3	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The aim of this course is to understand how sedimentary and metamorphic rocks are classified based on the mineralogy and textures and how these can be used to interpret their history. Upon completion of this course, the student will be able to identify sedimentary and metamorphic rocks and explain the processes by which the rocks formed based on the textural associations of the mineral assemblages.

2. Graphic construction of ACF, AKF and AFM diagrams.

3. Upon completion of this course, the student will be able to **p**reparation of mineral maps of India, calculation of grade and ore reserves etc.

Course Content: (6Hrs./Week)

Unit1- Sedimentary & Metamorphic Petrology

- Study of sedimentary and metamorphic rocks in thin sections with emphasis on texture, structure and mineral composition.
- Study of sedimentary and metamorphic rocks in hand specimen.
- Graphic construction of ACF, AKF and AFM diagrams.

Unit2- Mineral Exploration and Mining Geology

- Preparation of mineral maps of India.
- Graphical representation of production, export and import of important minerals.
- Calculation of grade and ore reserves.
- Interpretation of remote sensing data for mineral exploration.

Text Books:

TB1. W.S. Mackenzie, C. Guilford, Atlas of the Rock-Forming Minerals in Thin Section

TB2. Practical Handbook of Earth Science by Jane H. Hodgkinson; Frank D. Stacey, CRC Press

TB3. Practical Geology, Dr. Harish Kapasya, Himanshu Publications

Reference Books:

RB1. W.S. Mackenzie, C. Guilford, Atlas of the Rock-Forming Minerals in Thin Section

RB2. Practical Handbook of Earth Science by Jane H. Hodgkinson; Frank D. Stacey, CRC Press

RB3. Practical Geology, Dr. Harish Kapasya, Himanshu Publications

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To analyse the sedimentary and metamorphic rocks in thin sections with emphasis on texture, structure and mineral composition.
CO2	To understand the nature of sedimentary and metamorphic rocks in hand specimen. Graphic construction of ACF, AKF and AFM diagrams.
CO3	To gain the knowledge and preparation of mineral maps of India. Graphical representation of production, export and import of important minerals. Calculation of grade and ore reserves. Interpretation of remote sensing data for mineral exploration.

CO-PO-PSO Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2

M.Sc. Geology

Course code	**: MGLS307**			
Course Name	**: Petroleum Geology**			
Semester /Year	**: 3rd**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The main basic objective of this course is to understand the, how a geologist find out the hydrocarbon reserves by using the basic fundamentals of geology that needs to be understood and integrated with engineering data to effectively and optimally manage petroleum reservoirs.

Course Content: (Total Hrs.-40)

Unit 1:-Physical and chemical properties of natural gas, oil and bitumen, their mode of occurrence, kerogen-shales, origin of petroleum, coal bed methane and gashydrate.

Unit 2:-Reservoir rocks, their classification, important characters, structures and mechanics, migration of oil and gas, Gussove`s theory of oil and gas pools.

Unit 3:-Oil traps, their classification and characters, Surface indication of oil, geological, geophysical and geochemical prospecting for hydrocarbons.

Unit 4:-Drilling and well logging for oil, well completion, and secondary recovery.

Unit 5:-Geographical distribution of petroleum resources in world, Status of hydrocarbon exploration in India, important petroliferous basins of India,

Text Books:

TB1. Geology Of Petroleum 2Ed (Pb 2004) by LEVORSEN A.I.
TB2**.** Emmons William Harvey, Geology of Petroleum

Reference Books:

RB1. The World Of Petroleum by B.G. Deshpande, New Age International (P) Ltd.,

Publishers
RB2. Nath Mahendra, Fuel Geology, Vishal Publishing Co.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain the knowledge of different chemical constituents of oil and gas, Oil field brines, their classification, importance and alteration
CO2	To understand the knowledge about geophysical and geological methods for oil and gas exploration.
CO3	To understand and identify different petroliferous basins of India and their associated lithology, Stratigraphy, structure.
CO4	To understand about Classification and study of traps for oil and gas accumulation,
CO5	To analyses the structures like folds, faults, joints, unconformity, salt domes and Oil and gas fields associated with buried hills.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

M.Sc. Geology

Course code : MGLS308				
Course Name : Environment Geology				
Semester /Year : 3rd				
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The main objective to understand the interaction of humans with the geological environment, familiarize students of challenges of environmental geology in the urban environment, and teach practical contribution that geologists can make in managing human interaction with the physical environment.

Course Content: (Total Hrs.-40)

Unit 1:- Definition; History of Environmental Geology; Environmental Geology and Commercial reality; The tools of the Environmental geologist; Critical thinking about the environment;

Unit 2:- GEOLOGICAL RESOURCES: Economic mineral resources; Construction resources; Water resources; Aesthetic and Scientific geological resources (aesthetic, cultural and scientific importance of Geology).

Unit 3:- NATURAL HAZARDS: Exogenic hazards; Endogenic hazards; Engineering geology in extreme events.

Unit 4:- WASTE AND POLLUTION MANAGEMENT: Waste management and geological environment; Waste and Pollution; Waste and Society; Wastes in open dumps; Landfilling wastes; Effluent treatment and disposal; Waste gases and the atmosphere; Radioactive wastes and management;

Unit 5:- ENVIRONMENTAL GEOLOGY: AN URBAN CONCEPT: Urban Environments; Urban planning and geology;

Text Books:

TB1. Environmental Geology: Geology and the Human Environment by Bennett and Doyle by Wiley Publications
TB2. Environmental Geology by Jim Reichard by McGraw Hill
TB3. Environmental Science by Botkin and Keller by Wiley Publications

Reference Books:

RB1. Environmental Geology: Geology and the Human Environment by Bennett and Doyle by Wiley Publications
RB2. Environmental Geology by Jim Reichard by McGraw Hill
RB3. Environmental Science by Botkin and Keller by Wiley Publications

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To understand and learn the concepts of environmental geology,
CO2	To understand and learn the managing geological resources,
CO3	To understand and learn the appropriate use of the geological environment for waste disposal, and
CO4	To gain the knowledge and recognition of natural hazards and mitigation of their human impacts.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

M.Sc. Geology

4th Semester

Course code	**: MGLC401**			
Course Name	**: Geohydrology**			
Semester /Year	**: 4th**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To understand the Groundwater fluctuation: types, controlling factors Groundwater wells, types and methods Groundwater chemistry: Components of groundwater; Salinity in Groundwater Seawater intrusion and Classification and Indian salinity hazards, Artificial recharge of groundwater, Ground water Exploration: Surface geophysical methods, Groundwater Management and Development, Groundwater pollution: Arsenic, fluoride and Nitrate**.**

Course Content: (Total Hrs.-40)

Unit 1:-Occurrence and distribution of groundwater, hydrological cycle, hydrological properties of rocks, water table fluctuations.
Unit 2:-Theory of groundwater flow, Darcy's law and its application, determination of permeability, types of well; unconfined, confined flow condition, types and characteristics of Aquifers.
Unit 3:-Groundwater quality, problems of arsenic and fluorides, groundwater contaminations, groundwater conditions of India.
Unit 4:-Methods of artificial groundwater recharge, method of rainwater harvesting, groundwater legislation, groundwater provinces of India.
Unit 5:-Geological and geophysical methods – electrical (resistivity), seismic, gravity and magnetic methods.

Text Books:

TB1. Todd, D.K. (1980): Ground Water Hydrology, John Wiley & Sons, New York.
TB2. Bouver, H. (1978): Groundwater Hydrology, McGraw Hill.

Reference Books:

RB1. Davies, S.N. and Dc-West, R.J.N. (1966): Hydrology, John Wiley & Sons, New York.
RB2. Deming, D. (2002).Introduction to hydrogeology. McGraw Hill

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain knowledge, comprehend the hydrologic cycle and related major water quantity and quality challenges and their relevance to human health and well-being, ecosystems.
CO2	To understand the role of hydrology, water resources management and the legal and economic frameworks associated with addressing these challenge.
CO3	To understand and comprehend the chemistry of water and biological phenomena as related to water quality and contaminant transport in surface water and groundwater that provide for drinking water, agriculture, ecosystems, and industry.
CO4	To understand the physics of water flow and mass transport processes, can represent those processes with mass, momentum and energy conservation equations, and apply those equations in assessing water quantity and quality in surface- and ground-water systems.
CO5	To understand the statistical, analytical and numerical methods and associated limitations of modeling hydrologic flow and transport processes, and can apply quantitative models towards the analysis of water quantity, quality and management problems

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code	**: MGLC402**			
Course Name	**: Ore Genesis and Indian Mineral Deposits**			
Semester /Year	**: 4th**			
	L	**T**	**P**	**C**
	4			**4**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. This course will provide basic insights into the genesis of economic mineral deposits that are imperative for modern sustainable societies.
2. To understand the Ore forming processes, Tectonics and ore formation, Ore texture and genesis. Phase equilibria of sulphide and oxide, Ore in igneous rocks, metamorphic rocks, sedimentary placer deposits , Indian occurrence of metallic and non-metallic ores, Raw materials used in different industries and their specifications, metallogenic epochs and province of Indian sub continents, mineral Para genesis etc.
3. To understand the Indian mineral policy and regulations, future aspects and Uttarakhand mineral status**.**

Course Content: (Total Hrs.-40)

Unit 1:-Processes of ore formation, Structural, physico-chemical and stratigraphic controls of ore localization, wall rock alteration, Ore bearing fluids, their origin and migration, mineralization and tectonism.

Unit 2:-Indian distribution and characters of metallic ore deposits of copper, gold, lead and zinc, aluminum, magnesium, iron, manganese, chromium, tungsten, molybdenum.

Unit 3:-Indian distribution and characters of non-metallic minerals: coal and petroleum, mica, asbestos, barite, graphite, gypsum, refractories, abrasives, ceramics, fertilizers, cement, paints- pigments and gem stones.

Unit 4:-Metallogenic epochs and provinces of Indian subcontinent, Para genesis, zoning, mineral deposits of Indian oceans.

Unit 5:-National mineral policy and mineral conservation; India's status in mineral production, international aspects, future prospects, strategic, critical and essential minerals, mineral resources of Uttarakhand.

Text Books:

TB1. Karanth, R.V. (2000): Gems and gem Industry in India, Geol. Soc. India, Bangalore.
TB2. Krishnaswamy, S. (1979): India's Mineral Resources, Oxford and IBH Co.
TB3. Tiwari, S. K.: Ore Geology, economic mineral and mineral economics Vol.-2.
TB4. Evans, A.M. (1993): Ore Geology and Industrial Minerals, Blackwell.
TB5. Stanton, R.L. (1972): Ore Petrology, McGraw Hill.

Reference Books:

RB1. Barnes, H.L. (1979): Geochemistry of Hydrothermal Ore Deposits, John Wiley.
RB2. Guilbert, J.M. and Park, Jr.C.F. (1986): The Geology of Ore Deposits, Freeman.
RB3. Mookherjee, A. (2000): Ore Genesis-A Holistic Approach, Allied Publisher.
RB4. Jensen and Bateman Economic minerals
RB5. U.Prasad -Economic Mineral Deposits

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To understand the ore forming process in the earth and how the natural barrier controls them in suitable reservoir.
CO2	To understand the wide variety of metalliferousore forming processes.
CO3	To gain the knowledge and identify the ore deposits in wide variety of geological environments and how they formed and how they react with surrounding.
CO4	To understand the economic importance of metals and non-metals for the development in state as well as in the country.
CO5	To understand the mineral policy and the future aspect of the ores and to know the future possibility state wise.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2
CO4	2	1	2	2	1	1	3	1	1	3	2	3	1
CO5	1	2	1	1	2	3	1	3	1	3	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

M.Sc. Geology

Course code : MGLL403				
Course Name : Lab Course based on C401&C402				
Semester /Year : 4th				
	L	**T**	**P**	**C**
			3	**3**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Upon completion of this course, the student will be able to Analysis of hydrographs and estimation of infiltration capacity, contour maps and estimation of permeability and chemical analysis of water.
2. Upon completion of this course, the student will be able to identify the economic minerals in hand specimen.

3. Study of geological maps and sections of important oilfields of India and world and calculation of oil reserves.

Course Content: (Total Hrs.-9 Hrs./Week)

Unit1- Geohydrology

- Delineation of hydrological boundaries on water table, contour maps and estimation of permeability.
- Analysis of hydrographs and estimation of infiltration capacity.
- Chemical analysis of water in evaluation of aquifer parameters.
- Step drawdown tests, electric resistivity sounding for delineation of fresh and saline aquifers.
- Exercise on ground water exploration using remote sensing techniques.

Unit2- Ore genesis and Indian mineral deposits

- Study of economic minerals in hand specimen.
- Study of geological maps and sections of important oilfields of India and world. Calculation of oil reserves.
- Preparation of mineral maps of India. Graphical representation of production, export and import of important minerals. Calculation of grade and ore reserves. Interpretation of remote sensing data for mineral exploration.

.

Text Books:

TB2. Practical Handbook of Earth Science by Jane H. Hodgkinson; Frank D. Stacey, CRC Press

TB3. Practical Geology, Dr. Harish Kapasya, Himanshu Publications

Reference Books:

RB2. Practical Handbook of Earth Science by Jane H. Hodgkinson; Frank D. Stacey, CRC Press

RB3. Practical Geology, Dr. Harish Kapasya, Himanshu Publications

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To analyse the delineation of hydrological boundaries on water table, contour maps and estimation of permeability. To analysis of hydrographs and estimation of infiltration capacity. Chemical analysis of water in evaluation of aquifer parameters. Step drawdown tests, electric resistivity sounding for delineation of fresh and saline aquifers. Exercise on ground water exploration using remote sensing techniques.
CO2	Study of economic minerals in hand specimen. Study of geological maps and sections of important oilfields of India and world. Calculation of oil reserves.
CO3	To understand and preparation of mineral maps of India. Graphical representation of production, export and import of important minerals. Calculation of grade and ore reserves. Interpretation of remote sensing data for mineral exploration.

CO-PO-PSO Mapping

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	1	1	1	1	1	2	1	3	3	1	2	2
CO2	1	2	1	2	1	1	1	1	1	3	2	1	1
CO3	1	3	1	1	2	1	2	1	2	3	1	3	2

M.Sc. Geology

Course code : MGLE404				
Course Name : Geological Field Training Tour				
Semester /Year : 4th				
	L	**T**	**P**	**C**
				3

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. Geological field work is important to understand rocks in their natural environment and their natural relationship to one another.

2. It seeks to describe and explain the surface feature and underground structure of the lithosphere based upon observations and inferences.

Course Content: (Total Hrs.-40)

Students will be required to visit geologically important areas including mines, dams, oil fields, fossiliferous sequences and laboratories/institutes of repute and submit a report thereon, under the supervision of a faculty member.

The field work should be maximum 07 days

Text Books:

TB1. Mathur S.M., Guide To Field Geology
TB2. Gokhale N.W., A Guide to Field Geology

Reference Books:

RB1. Mathur S.M., Guide To Field Geology
RB2. Gokhale N.W., A Guide to Field Geology

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	The course is intended to expose students to any economic deposit, familiarize them about host rock and economic mineral relationship, variable geometry of ore bodies.
CO2	To understand the planning of exploration and exploitation, Open and/or underground mine section.
CO3	To understand how to identify the structures and microstructures.
CO4	To understand the fundamentals work on the field.
CO5	To gain the knowledge and develop skills for the writing of the tour report.

M.Sc. Geology

Course code : MGLE405				
Course Name : Project/Dissertation				
Semester /Year : 4th				
	L	**T**	**P**	**C**
				6

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. The main objective of this course to develop awareness and interest towards research.

2. The main objective of this course to development of scientific temperament.

Course Content:

The area of dissertation shall be assigned to the students at the end of second semester based on the expertise available in the Department. The project oriented dissertation must be submitted by the end of fourth semester. During the course of completion of dissertation work the students will be required to complete various assignments given to them by their respective supervisors or the Head of Department for the purpose of their evaluation. Beside classroom seminars, the students will have to present their dissertation work in the form of seminar before the board of examiners including the supervisors which will be followed by viva voce examination.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	To gain and develop awareness and interest towards research.
CO2	To understand the development of scientific temperament.
CO3	To understand the fundamentals of research methodology.
CO4	To understand and develop skills for the writing of thesis and scientific papers.