KURUKSHETRA UNIVERSITY
KURUKSHETRA

Scheme of Examination and Syllabus for

Under-Graduate Programme (Single Major)

Subject: Geology

Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020 w.e.f. 2023-24 (in phased manner)

(First Year)

Course Type	Course Code	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
SEMESTER-1								
CC-1/ MCC-1 @4 credit	B23-GGY-101	Physical Geology (T)	3	3	20	50	70	3 hrs.
		Physical Geology (P)	1	2	10	20	30	3 hrs.
MCC-2 @4 credit	B23-GGY-102	Geomorphology (T)	3	3	20	50	70	3 hrs.
		Geomorphology (P)	1	2	10	20	30	3 hrs.
CC-M1 @2 credit	B23-GGY-103	Fundamentals of Geology	2	2	15	35	50	3 hrs.
MDC-1 @3 credits	B23-GGY-104	An Introduction to Geology (T)	2	2	15	35	50	3 hrs.
		An Introduction to Geology (P)	1	2	5	20	25	3 hrs.
SEMESTER-2								
CC-2/ MCC-3 @4 credit	B23-GGY-201	Petrology and Mineralogy (T)	3	3	20	50	70	3 hrs.
		Petrology and Mineralogy (P)	1	2	10	20	30	3 hrs.
DSEC-1 @4 credit	B23-GGY-202	Field Geology (T)	3	3	20	50	70	3 hrs.
		Field Geology (P)	1	2	10	20	30	3 hrs.
CC-M2 @2 credit	B23-GGY-203	Geoscience and Society	2	2	15	35	50	3 hrs.
MDC-2 @3 credits	B23-GGY-204	Rocks and Minerals (T)	2	2	15	35	50	3 hrs.
		Rocks and Minerals (P)	1	2	5	20	25	3 hrs.

(Second Year)

Course Type	Course Code	Nomenclature of Paper	Credits	Hours / Week	Internal marks	External Marks	Total Marks	Exam Duration
SEMESTER-3								
CC-3/ MCC-4/ CC-M3 @4 credit	B23-GGY-301	Palaeontology and Stratigraphy (T)	3	3	20	50	70	3 hrs.
		Palaeontology and Stratigraphy (P)	1	2	10	20	30	3 hrs.
MCC-5 @4 credit	B23-GGY-302	Geochemistry (T)	3	3	20	50	70	3 hrs.
		Geochemistry (P)	1	2	10	20	30	3 hrs.
MDC-3 @3 credits	B23-GGY-303	Earth Resources (T)	2	2	15	35	50	3 hrs.
		Earth Resources (P)	1	2	5	20	25	3 hrs.
SEMESTER-4								
CC-4/ MCC-6 @4 credit	B23-GGY-401	Structural Geology and Engineering Geology (T)	3	3	20	50	70	3 hrs.
		Structural Geology and Engineering Geology (P)	1	2	10	20	30	3 hrs.
MCC-7 @4 credit	B23-GGY-402	Igneous and Metamorphic Petrology (T)	3	3	20	50	70	3 hrs.
		Igneous and Metamorphic Petrology (P)	1	2	10	20	30	3 hrs.
MCC-8 @4 credit	B23-GGY-403	Sedimentology (T)	3	3	20	50	70	3 hrs.
		Sedimentology (P)	1	2	10	20	30	3 hrs.
DSE-1 @4 credit	B23-GGY-404	Mineral Exploration (T)	3	3	20	50	70	3 hrs.
		Mineral Exploration (P)	1	2	10	20	30	3 hrs.
		Or						
	B23-GGY-405	Mineral Resources (T)	3	3	20	50	70	3 hrs.
		Mineral Resources (P)	1	2	10	20	30	3 hrs.

(Third Year)

Course Type	Course Code	Nomenclature of Paper	Credits	Hours / Week	Internal marks	External Marks	Total Marks	Exam Duration
SEMESTER-5								
CC-5/ MCC-9 @4 credit	B23-GGY-501	GIS and Remote Sensing (T)	3	3	20	50	70	3 hrs.
		GIS and Remote Sensing (P)	1	2	10	20	30	3 hrs.
MCC-10 @4 credit	B23-GGY-502	Exploration and Surveying (T)	3	3	20	50	70	3 hrs.
		Exploration and Surveying (P)	1	2	10	20	30	3 hrs.
DSE-2 @4 credit	B23-GGY-503	Natural Hazards (T)	3	3	20	50	70	3 hrs.
		Natural Hazards (P)	1	2	10	20	30	3 hrs.
	Or							
	B23-GGY-504	Environmental Geology (T)	3	3	20	50	70	3 hrs.
		Environmental Geology (P)	1	2	10	20	30	3 hrs.
DSE-3 @4 credit	B23-GGY-505	Disaster Management (T)	3	3	20	50	70	3 hrs.
		Disaster Management (P)	1	2	10	20	30	3 hrs.
	Or							
	B23-GGY-506	Groundwater Management (T)	3	3	20	50	70	3 hrs.
		Groundwater Management (P)	1	2	10	20	30	3 hrs.
SEMESTER-6								
CC-6/ MCC-11/ CC-M6 @4 credit	B23-GGY-601	Hydrogeology (T)	3	3	20	50	70	3 hrs.
		Hydrogeology (P)	1	2	10	20	30	3 hrs.
MCC-12 @4 credit	B23-GGY-602	Economic and Mining Geology (T)	3	3	20	50	70	3 hrs.
		Economic and Mining Geology (P)	1	2	10	20	30	3 hrs.
DSE-4 @4 credit	B23-GGY-603	Oceanography (T)	3	3	20	50	70	3 hrs.
		Oceanography (P)	1	2	10	20	30	3 hrs.
	Or							
	B23-GGY-604	Industrial Geology-I (T)	3	3	20	50	70	3 hrs.
		Industrial Geology-I (P)	1	2	10	20	30	3 hrs.
DSE-5 @4 credit	B23-GGY-605	Climatology (T)	3	3	20	50	70	3 hrs.
		Climatology (P)	1	2	10	20	30	3 hrs.
	Or							
	B23-GGY-606	Crystallography and Mineral Optics (T)	3	3	20	50	70	3 hrs.
		Crystallography and Mineral Optics (P)	1	2	10	20	30	3 hrs.

(Fourth Year)

Course Type	Course Code	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration
SEMESTER-7 (FOR HONOURS/HONOURS WITH RESEARCH IN MAJOR SUBJECT)								
CC-H1 @4 credit	B23-GGY-701	Advanced Geochemistry	4	4	30	70	100	3 hrs.
CC-H2 @4 credit	B23-GGY-702	Advanced Mining Geology	4	4	30	70	100	3 hrs.
CC-H3 @4 credit	B23-GGY-703	Geology and climate change	4	4	30	70	100	3 hrs.
DSE-H1 @4 credit	B23-GGY-704	Medical Geology	4	4	30	70	100	3 hrs.
	Or							
	B23-GGY-705	Petroleum Geology	4	4	30	70	100	3 hrs.
PC-H1 @4 credit	B23-GGY-706	Physical Survey based Report-I	4	8	30	70	100	3 hrs.
SEMESTER-8 (FOR HONOURS/ HONOURS WITH RESEARCH IN MAJOR SUBJECT								
CC-H4 @4 credit	B23-GGY-801	Geological Survey/Mapping	4	4	30	70	100	3 hrs.
CC-H5 @4 credit	B23-GGY-802	Research Methodology	4	4	30	70	100	3 hrs.
CC-H6 @4 credit	B23-GGY-803	Industrial Geology- II	4	4	30	70	100	3 hrs.
DSE-H2 @4 credit	B23-GGY-804	Himalayan Geology	4	4	30	70	100	3 hrs.
	Or							
	B23-GGY-805	Geology of India	4	4	30	70	100	3 hrs.
PC-H2 @4 credit	B23-GGY-806	Physical Survey based Report-II	4	8	30	70	100	3 hrs.
Or								
CC-H4 @4 credit	B23-GGY-801	Geological Survey/Mapping	4	4	30	70	100	3 hrs.
CC-H5 @4 credit	B23-GGY-802	Research Methodology	4	4	30	70	100	3 hrs.
Project/ Dissertation @12 credit	B23-GGY-807	Research Work	12	-	-	-	300	3 hrs.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	I		
Name of the Course	Physical Geology		
Course Code	B23-GGY-101		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-1/MCC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand Geology and Its relation to mankind. 2. Understand Earth Interior. 3. Learn about the Lithospheric Plates of Earth. 4. Learn about formation of Volcanoes and Earthquakes. 5*. Understand the topography and physiography of an area.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Introduction to various branches of Earth Science, General characteristics and origin of the Universe, Solar System and its planets, Meteorites and Asteroids, Earth in the Solar System: origin,	11

	size, shape, mass, density, rotational and revolution parameters and its age.	
II	Interior of Earth: Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere, Convection in Earth's core and production of its magnetic field, Mechanical layering of the Earth.	11
III	Plate Tectonics: Concept of plate tectonics, sea-floor spreading and continental drift, Geodynamic elements of Earth: Mid Oceanic Ridges, trenches, transform faults and island arcs.	12
IV	Continents, mountains and rift valleys, Earthquake and Earthquake belts, Volcanoes: types, products and their distribution.	11
V*	Detailed study of topographic sheets, preparation of physiographic description of an area, study of Seismic Zones in India.	30

Suggested Evaluation Methods

Internal Assessment:	**End Term Examination:**
➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks**	**50**
➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Principles of Physical Geology- A. Holmes
- Plate Tectonics and Crustal Evolution- K.C. Condie
- Aspects of Tectonics- K.S. Valdiya
- Essentials of The Earth Science- K. Kelvin

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	I		
Name of the Course	Geomorphology		
Course Code	B23-GGY-102		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-2		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the surface geological processes. 2. Understand their effect on mankind and environment. 3. Know various geomorphological processes. 4. Enhance knowledge about changes on the Earth's surface. 5*. Understand geomorphological models and soil profile		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Basic concepts of Geomorphology, Fundamentals of Erosion, Weathering and its types: physical, chemical and biological.	11
II	Soil profile and Soil formation, Mass wasting: types and causes, Drainage patterns and causes of its formations.	11

III	Processes of Transportation, Erosional and Depositional features of Fluvial, Arid and Glacial geomorphic cycles.	12
IV	Cycle concept in Geomorphology, Peneplanation and its types, Uplift and Rejuvenation, Paleosols and alluvial fans in neo-tectonic interpretation.	11
V*	Study of major geomorphic features and their relationships with outcrops through physiographic models, Study of soil profile of any specific area.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Principles of Physical Geology- A. Holmes
- Principles of Geomorphology- W.D. Thornbury
- Geomorphology- V.K. Sharma
- Essentials of The Earth Science- Kelvin

Session: 2023-24		
Part A - Introduction		
Subject	Geology	
Semester	I	
Name of the Course	Fundamentals of Geology	
Course Code	B23-GGY-103	
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M1	
Level of the course (As per Annexure-I)	100-199	
Pre-requisite for the course (if any)	N.A.	
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand Geology and its branches. 2. Understand the Earth and Solar system. 3. Learn about Geological Time Scale and Physiography of India. 4. Learn ecological spheres and their relationship with Earth's surface.	
Credits	Theory	Total
	2	2
Contact Hours	30	30
Max. Marks: 50 **Internal Assessment Marks: 15** **End Term Exam Marks: 35**	**Exam Time: 3 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Geology as an interdisciplinary science, Branches of Geology and their basic understanding, Development of Geology: catastrophism, The birth of modern Geology.	7

II	Earth's place in the Solar System, physical features of the Earth, other basic features (mass, shape, size, density, etc.) of Earth. Interior of Earth.	8
III	Geological Time Scale, Physiographic and Geological sub-divisions of India, Basic concepts and Application of GIS and GPS.	7
IV	Physical and chemical properties of Earth's spheres: hydrosphere, atmosphere and biosphere, Distribution of land and water on Earth's surface.	8
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory** • Class Participation: **02 marks** • Seminar/presentation/assignment/quiz/class test etc.: **03 marks** • Mid-Term Exam: **10 marks**		**End Term Examination: 35**
Part C-Learning Resources		
Recommended Books/e-resources/LMS: • Understanding the Earth, Press, F. and Siever, R., W.H. Freeman & Co. • An Introduction to Physical Geology, Tarbuck, Lutgens, Tasa, Eleventh Edition, Pearson Publication. • Principles of Physical Geology- A. Holmes		

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	I		
Name of the Course	An Introduction to Geology		
Course Code	B23-GGY-104		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand Geology and its branches. 2. Understand the Earth and Solar system. 3. Learn about Geological time scale and Physiography of India. 4. Learn ecological spheres and their relationship with Earth's surface. 5*. Get Knowledge about interior of Earth through Models.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 (50 Th.+ 25 Pr.) **Internal Assessment Marks: 20 (15 Th.+ 05 Pr.)** **End Term Exam Marks: 55 (35 Th.+ 20 Pr.)**		**Exam Time: 3 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours

I	Geology as a Multidisciplinary science, Branches of Geology and their basic understanding, Development of Geology: catastrophism, The birth of modern Geology.	7
II	Earth's place in the Solar System, physical features of the Earth, other basic features (mass, shape, size, density, etc.) of Earth. Interior of Earth.	8
III	Geological Time Scale, Physiographic and Geological sub-divisions of India, Basic concepts and Application of GIS and GPS.	7
IV	Physical and chemical properties of Earth's spheres: hydrosphere, atmosphere and biosphere, Distribution of land and water on Earth's surface.	8
V*	Physiographic models of India, Models of Interior of Earth, Preparation of Maps of Geological subdivisions of India.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **02 marks** • Seminar/presentation/assignment/quiz/class test etc.: **03 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **05 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **35** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Principles of Physical Geology- A. Holmes
- Understanding the Earth, Press, F. and Siever, R., W.H. Freeman & Co.
- An Introduction to Physical Geology, Tarbuck, Lutgens, Tasa, Eleventh Edition, Pearson Publication.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	II		
Name of the Course	Petrology and Mineralogy		
Course Code	B23-GGY-201		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-2/MCC-3		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Acquire knowledge about structural bonding and classification of the minerals. 2. Understand physical, chemical, and optical properties of silica group of minerals and mafic minerals. 3. Learn about Rocks, their types, composition and uses. 4. Get elementary idea of Magma and its composition, differentiation and Physical properties. 5*. Understand the physical properties of Minerals and Rocks.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Mineral: definition; Types of bonding, Isomorphism, Polymorphism, Pseudomorphism, Classification of minerals, Physical and Chemical properties of minerals.	11

II	Optical properties of minerals, Study of physical, chemical and optical properties of Quartz (Amethyst, Rosy quartz, Rutilated quartz, Chalcedony and Agate), Amphibole (Hornblende, Tremolite and Actinolite), Pyroxene (Augite and Diopside) and Feldspar (K-Feldspar, Albite, Anorthite, Orthoclase and Anorthoclase) group of minerals.	11
III	Rocks: Definition, Types of rocks, Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks, Rock Cycle, uses associated with different Rock types, Introduction to Extraterrestrial Rocks.	12
IV	Composition and types of magma, Physical properties of magma: temperature, viscosity and density, Magmatic differentiation and assimilation, Bowen reaction series.	11
V*	Study of physical properties of minerals in hand specimen: Olivine, Garnet, Kyanite, Staurolite, Tourmaline, Augite, Actinolite, Tremolite, Hornblende, Talc, Muscovite, Biotite, Orthoclase, Plagioclase, Microcline and Quartz varieties (Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz, Rock crystal). Study of Igneous rocks (Granite, Pegmatite, Microgranite, Dolerite, Granodiorite and Dolerite porphyry), Metamorphic rocks (Hornblende schist, Fuschite quartzite, Hematite jasper quartzite) and Sedimentary rocks (Shale, Limestone, Sandstone) in hand specimen.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Petrology, Igneous, Sedimentary, Metamorphic- Ehlers Ernest G. and Blatt, Harvey.
- A Text Book of Geology- P. K. Mukherjee.
- Engineering and General Geology- Parbin Singh.
- The Principles of Petrology- G. W. Tyrell**.**

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	II		
Name of the Course	Field Geology		
Course Code	B23-GGY-202		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	DSEC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn the basic idea of field equipment. 2. Get elementary Idea about field work. 3. Study types of out crops present in the field. 4. Learn about drawing of a geological section. 5*. Learn about how to interpret field data.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Field equipment and their uses: Topographic maps, Contour Maps, compass, Hammer, Altimeter, Measuring Tape, Field notebook.	11

II	Methods of field work: Preliminary survey, geological mapping, sample collection, laboratory work, writing a report.	11
III	Field outcrop patterns and geologic structures: Horizontal ground, undulating ground, Horizontal beds, inclined beds, Vertical beds.	12
IV	Drawing the geological cross sections: contour lines, structural attitude of data, Thickness of each formation, determination of Dip and Strike.	11
V*	Measuring Dip and Strike, Preparation of Geological Map of a given area. Collection of lithological data	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- A Guide to Field Geology- N.W. Gokhale.
- Field Geology-F.H. Lahee.
- Guide to Field Geology- S.M. Mathur.
- Manual of Field Geology- Robert R. Compton.

Session: 2023-24		
Part A - Introduction		
Subject	Geology	
Semester	II	
Name of the Course	Geoscience and Society	
Course Code	B23-GGY-203	
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M2	
Level of the course (As per Annexure-I)	100-199	
Pre-requisite for the course (if any)	N.A.	
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Acquire Knowledge of the origin of Earth. 2. Understand Plate Tectonics and different type of plates of Earth. 3. Learn about Engineering Geology. 4. Learn about earth's resources and its significance.	
Credits	Theory	Total
	2	2
Contact Hours	30	30
Max. Marks: 50 **Internal Assessment Marks: 15** **End Term Exam Marks: 35**	**Exam Time: 3 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Origin and structure of Earth, Origin and evolution of life through Earth history, Elementary idea of rocks, their types, rock cycle, minerals and gemstones.	7

II	Elementary idea of various Earth processes, continental drift and plate tectonics, Orogenic and epeirogenic movements.	8
III	Elementary idea of geological considerations in site evaluation of engineering, construction, mining and other geological works.	7
IV	Environmental changes through the Earth history, Significance of Earth resources to mankind and society, Hydrological cycle and water budget of an Earth.	8

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **02 marks** • Seminar/presentation/assignment/quiz/class test etc.: **03 marks** • Mid-Term Exam: **10 marks**	**End Term Examination: 35**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Understanding the Earth, Press, F. and Siever, R., W.H. Freeman & Co.
- Palaeontology, Jain, P.C. and Anantharaman, M.S., Vishal Publishing Co.
- An Introduction to Physical Geology, Eleventh Edition, Tarbuck, Lutgens and Tasa, Pearson Publication.
- Principles of Engineering Geology and Geotechnics, Krynine/Judd., Jain Book Agency.
- Ground water Hydrology, Todd David K., PHI Learning.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	II		
Name of the Course	Rocks and Minerals		
Course Code	B23-GGY-204		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC-2		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Acquire knowledge about structural bonding and classification of the minerals. 2. Understand physical, chemical, and optical properties of silica group of minerals and mafic minerals. 3. Learn about Rocks, their types, composition and uses. 4. Get elementary idea about Magma and its composition, differentiation and Physical properties. 5*. Understand the physical properties of Minerals and Rocks		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 (50 Th.+ 25 Pr.) **Internal Assessment Marks: 20 (15 Th.+ 05 Pr.)** **End Term Exam Marks: 55 (35 Th.+ 20 Pr.)**		**Exam Time: 3 Hrs.**	
Part B- Contents of the Course			
Instructions for Paper- Setter Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.			
Unit	**Topics**		**Contact Hours**

I	Mineral: definition, Isomorphism, Polymorphism, Pseudomorphism, Uses of minerals, Classification of minerals. Physical and Chemical properties of minerals, Gem variety of minerals.	7
II	Physical and Chemical properties of Quartz (Amethyst, Rosy quartz, Rutilated quartz, Chalcedony and Agate) and Feldspar (K- Feldspar, Albite, Anorthite, Orthoclase and Anorthoclase) group of minerals.	8
III	Rocks: Definition, Classification of Rocks and Types of rocks, Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks. Rock Cycle.	7
IV	Composition and types of magma, Physical properties of magma: temperature, viscosity and density, Magmatic differentiation, Bowen reaction series.	8
V*	Study of physical properties of minerals in hand specimen: Olivine, Garnet, Kyanite, Staurolite, Tourmaline, Augite, Actinolite, Tremolite, Hornblende, Talc, Muscovite, Biotite, Orthoclase, Plagioclase, Microcline and Quartz varieties (Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz, Rock crystal). Study of Igneous rocks (Granite, Pegmatite, Microgranite, Dolerite, Granodiorite and Dolerite porphyry), Metamorphic rocks (Hornblende schist, Fuschite quartzite, Hematite jasper quartzite) and Sedimentary rocks (Shale, Limestone, Sandstone) in hand specimen.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **02 marks** • Seminar/presentation/assignment/quiz/class test etc.: **03 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **05 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **35** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Petrology, Igneous, Sedimentary, Metamorphic- Ehlers Ernest G. and Blatt, Harvey.
- A Text Book of Geology- P. K. Mukherjee.
- Engineering and General Geology- Parbin Singh.
- The Principles of Petrology- G. W. Tyrell**.**

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Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	III		
Name of the Course	Palaeontology and Stratigraphy		
Course Code	B23-GGY-301		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-3/MCC-4/CC-M3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn about fossils and evolutionary history of life. 2. Learn about morphology and classification of major vertebrate and invertebrate fossil species. 3. Learn about basic principles of stratigraphy and Geological Time Scale and unconformable contacts in detail. 4. Learn various branches of stratigraphy with special emphasis on sequence stratigraphy and basic concepts of correlation. 5*. Learn to study fossils and about stratigraphy of India.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours

I	Fundamentals: definition, objectives and scope, nature of fossil record and their uses, types of fossil and their mode of preservation, evolution of life through ages.	11
II	Invertebrate paleontology: morphology, classification, evolutionary trends, geological history and geographical distribution of brachiopods, gastropods, cephalopods and trilobite.	11
III	Define stratigraphy: scope of stratigraphy, principles of stratigraphy, Unconformity: angular unconformity, disconformity, paraconformity, and nonconformity, Stratigraphic units: classification and nomenclature of units (lithostratigraphy, biostratigraphy, chrono-stratigraphy and geochronology).	12
IV	Precambrian Stratigraphy: Dharwar, Cuddapah and Vindhyans, Paleozoic Stratigraphy of India with emphasis on Gondwana Sequence, Deccan Traps.	11
V*	Practical & exercises on stratigraphy, Megascopic study of important invertebrate, vertebrate and plant fossils.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- An Introduction to the Study of Fossil Plants, Walton, J., Adam & Charles Black.
- Paleontology Invertebrate, Woods, H., CBS Publications.
- Principles of Stratigraphy, Lemon, R.L., Merrill Publishing.
- Fundamentals of Historical Geology and Stratigraphy of India, Boggs, S., Jr. Wiley.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	III		
Name of the Course	Geochemistry		
Course Code	B23-GGY-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-5		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Acquire the idea about elemental composition in different spheres of Earth. 2. Know the application of ionic variability, trace and isotropic concentration in Geology. 3. Learn about geochemical cycles and dating methods. 4. Learn about stable isotopes. 5*. To represent geochemical data graphically and to do interpretation.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Chemical composition and characteristics of Atmosphere, Lithosphere and Hydrosphere, Goldschmidt's classification of	11

	elements, Application of Thermodynamics in Geology.	
II	Principles of ionic substitution in minerals, Physio-chemical factors in sedimentation, Applications of trace elements in Geology and REE patterns;	11
III	Geochemical cycles, Nitrogen Cycle, Oxygen Cycle, Carbon Cycle, Principles of U-Pb, Rb-Sr, K-Ar, C-14 methods in dating.	12
IV	Significance of stable isotope Geochemistry in Geology, Isotope fractionation in nature, Stable Isotopes of oxygen, carbon and hydrogen and their determination.	11
V*	To study the geochemical data in tabular form. To draw and interpret the Harker variation diagram. To draw O^{16} and O^{18} diagram from already present data.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Introduction to Geochemistry, Mason, B. and Moore, C.B., 1991, Wiley Eastern.
- Introduction to Geochemistry, Krauskopf, K.B., 1967, McGraw Hill.
- Principles of Isotope Geochemistry, Faure, G., 1986, John Wiley.
- Geochemistry, Brownlow, A.H. Prentice-Hall.
- Geochemical Thermodynamics, Nordstrom, D.K. and Munoz, J.L, Blackwell.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	III		
Name of the Course	Earth Resources		
Course Code	B23-GGY-303		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC-3		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn about the energy scenario, production, demand and consumption of important mineral resources in India. 2. Learn about origin, types, physical and chemical properties of coal. 3. Know about origin, migration and entrapment of petroleum. 4. Learn concepts of nuclear energy. 5*. Learn about Coal, Petroleum and Nuclear deposits of India.		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 (50 Th.+ 25 Pr.) **Internal Assessment Marks: 20 (15 Th.+ 05 Pr.)** **End Term Exam Marks: 55 (35 Th.+ 20 Pr.)**		**Exam Time: 3 Hrs.**	
Part B- Contents of the Course			

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours

I	A brief overview of energy mineral resources of India, sources of renewable and non-renewable energy, Importance of sustainable energy resources in the development of the country.	7
II	Coal: definition, types, coalification process, rank of coal, properties of coal: moisture, ash content, volatile matter.	8
III	Source rock, Reservoir rock, traps, migration of oil and gas, characteristics of Reservoir Rocks and Cap Rock, major oil and gas fields of India.	7
IV	Radioactivity and nuclear energy, important atomic minerals, their mode of occurrence and association, U and Th deposits of India, Peaceful uses of nuclear energy, nuclear environmental hazards.	8
V*	Distribution of coal, petroleum,uranium and thorium deposits of India.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **02 marks** • Seminar/presentation/assignment/quiz/class test etc.: **03 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **05 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **35** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Economic Mineral Deposits, Bateman, A.M., Chapman and Hall.
- Ore Deposits of India, Gokhale and Rao, Thomson Press, Delhi.
- India's Mineral Resources, Krishnaswami S., Oxford & IBH.
- A Handbook of minerals, Crystals, Rocks and Ores, Parmod, A.O., New India Publishing Agency – 2009.
- Economic Geology – Economic Mineral Deposits of India,, Prasad, U., CBS Publishers Ltd.

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Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	IV		
Name of the Course	Structural Geology and Engineering Geology		
Course Code	B23-GGY-401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-4/MCC-6		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand about basics of structural geology. 2. Understand about the processes of folding, faulting and jointing of the strata and their identification in the field. 3. Get knowledge of engineering properties of rock and their use as construction material. 4. Know about various engineering structures, their site selection, evaluation and impact of natural hazards on engineering structures 5*.Learn about data analysis of Fold, Fault and RMR		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	
Part B- Contents of the Course			

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours

I	Elements of Structural Geology: Attitude of beds, Strike and Dip, Deformation of rocks - Force, Stress, Strain and Rupture, Folds: their morphology, genetic and geometric classification, recognition of folds on maps and in the field.	11
II	Faults, their geometric and genetic classification, recognition of faults on maps and in the field, Joints and their classification and recognition in field.	11
III	Introduction to Engineering Geology, Engineering properties of rocks, rocks as building and construction materials and basis of their selection and use, Rock mass rating.	12
IV	Engineering structures: dams, tunnels, buildings, highways and bridges, Techniques for selection and evaluation of sites for various engineering structures.	11
V*	Study of diagnostic morphological characters of faults and fold in hand specimen, Study of Geological/ Structural maps and cross-sections, Numerical exercise on structural problems, Numerical based on stress/strain and RMR.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Structural Geology -M.P. Billing.
- Foundation of Structural Geology -R.G. Park.
- Principles of Structural Geology -G.M. Mevin.
- Theory of Structural Geology- N.W. Gokhale.
- Engineering Geology- Krynine and Judd.
- Engineering Geology- Blyth.
- Soil Mechanics- T.W. Lambe and R. Whitman.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	IV		
Name of the Course	Igneous and Metamorphic Petrology		
Course Code	B23-GGY-402		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-7		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Get elementary idea about Magma and its composition, differentiation and Physical properties. 2. Learn about Phase rules, component systems and various igneous rocks. 3. Understand about formation of various igneous rocks. 4. Get elementary idea of metamorphism and metamorphic rocks 5*. Learn about Igneous and Metamorphic rock samples.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	
Part B- Contents of the Course			
Instructions for Paper- Setter Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.			
Unit	**Topics**		**Contact Hours**

I	Composition and types of magma, Physical properties of magma: temperature, viscosity and density, magmatic differentiation and assimilation, Bowen reaction series.	11
II	Phase diagram and their uses in igneous and metamorphic petrology, Phase rule, one component system; two component systems: Congruent melting and Incongruent melting, Solid solution, Basics of ternary systems.	11
III	Igneous Rocks: common Igneous minerals, method of emplacement of igneous rocks, classification and texture of igneous rocks, Physical, petrographical and chemical properties of igneous rocks: Granite, Rhyolite, Pegmatite, Syenite, Diorite, Basalt and Dolerite.	12
IV	Metamorphism: definition, scope, agents and types, Concept of grade, zone and facies of metamorphism, Structure and texture of metamorphic rocks, metamorphic differentiation.	11
V*	Microscopic and Megascopic study of Igneous and Metamorphic Rock samples.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Principles of Petrology- G.W. Tyrrell.
- Petrology- Ehlers and Blatt.
- Petrology of Igneous and Metamorphic Rocks- Best.
- Igneous and Metamorphic Petrology- Turner and Verhoogen.
- Petrology of Igneous Rocks- Hatch, Wells and Wells.
- Petrology of Igneous and Metamorphic Rocks of India- Chatterjee.
- Petrography Williams- Turner and Gilbert.
- The Studies of Rocks in Thin Section- Moor House.

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Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	IV		
Name of the Course	Sedimentology		
Course Code	B23-GGY-403		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-8		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the concept of sedimentation, origin of sedimentary rocks and their grain size relations. 2. Understand the properties of sedimentary rocks, their structures and various types of sands. 3. Learn types of sedimentary rocks, their classification and significance. 4. Understand Heavy minerals and their role in various research aspects. 5*. Know about sedimentary rocks and sedimentary grains.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	

Part B- Contents of the Course

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours

I	Origin of sediments and sedimentary rocks, concept of size of sediments, descriptive size terms, size classification: shape and roundness of sediment grains; packing of grains.	11
II	Porosity, permeability, oolites, sperulites, Bedding and its significance, Sedimentary Structures: primary, secondary and organic. Shoestring sands, wedge shaped sands, sheet sands, sedimentary dykes and sills, reefs and mud mounds.	11
III	Gravels, Conglomerates: their classification and significance, Sandstones: their mineralogy and classification into arenites, wackes and mudstones. Matrix: its types; greensands, placer sands.	12
IV	Shales, marls and limestones, Heavy minerals: definition, methods of separation and their significance, provenance of sediments, lithification and diagenesis of sediments.	11
V*	Microscopic and Megascopic study of Sedimentary Rock samples. Grain Size Analysis.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Sedimentary Rocks - F.J. Pettijohn.
- Petrology of Sedimentary Rocks- J. T. Greensmith.
- Sedimentary Rocks - Prothero and Schwab.
- Sedimentology and Stratigraphy - Gary Nichols.
- Principles of Sedimentology and Stratigraphy - Sam Boggs.
- Sedimentology – McLane.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	IV		
Name of the Course	Mineral Exploration		
Course Code	B23-GGY-404		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	DSE-1		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand mineral exploration and applications of geological mapping in it. 2. Acquire basic concepts of geological and geochemical prospecting. 3. Know the role of geophysical methods and logging tools in mineral exploration. 4. Understand numerical approach to mineral exploration and various methods of ore reserve estimation as well as application of various software in mineral exploration. 5*. Learn about Reserve Estimation of minerals.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	
Part B- Contents of the Course			
Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.			
Unit	**Topics**		**Contact Hours**

I	Introduction: basic definitions, historical development, overview of various stages of mineral exploration: activities, data and tools.	11
II	Basic concepts of geological prospecting: geological indicators, lithological and structural controls of mineralization, geobotanical observations, Basic concepts of geochemical prospecting: planning, Soil Sampling analysis and interpretation.	11
III	Different techniques in mineral exploration: drilling, sampling, core logging, geological plans and sections, Overview of geophysical methods useful in mineral prospecting: gravity method, electromagnetic method.	12
IV	Principles of Reserve Estimation: density and bulk density, factors affecting reliability of reserve estimation, reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks).	11
V*	Regional exploration data analysis and ore reserve estimation, Exercises related to trenching, pitting and drilling data.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Introduction to Mineral Exploration, Moon, C.J., Whateley, M.K.G. and Evans, A.M., Blackwell Science, 2nd Ed.
- Mineral Exploration: Recent Strategies, Rajendran, S., Srinivasamoothy, K. and Aravindan S., New India Pub.
- Mineral Prospecting and Exploration, T.C Bagchi, Kalyani Publication.
- Modelling and Geochemical Exploration of Mineral Deposits, Talapatra, A.K., Capital Publishing.

Session: 2023-24			
Part A - Introduction			
Subject	Geology		
Semester	IV		
Name of the Course	Mineral Resources		
Course Code	B23-GGY-405		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	DSE-1		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	N.A.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Know about the energy scenario, production, demand and consumption of important mineral resources in India. 2. Learn about origin, types, physical and chemical properties of coal. 3. Know about origin, migration and entrapment of petroleum. 4. Get the concepts of nuclear energy and nuclear energy. 5*. Learn about Coal, Petroleum and Nuclear deposits of India.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Th.+ 30 Pr.) **Internal Assessment Marks: 30 (20 Th.+ 10 Pr.)** **End Term Exam Marks: 70 (50 Th.+ 20 Pr.)**		**Exam Time: 03 Hrs.**	
Part B- Contents of the Course			

Instructions for Paper- Setter

Question No. 1 is compulsory and comprising short answer type questions spread over the entire syllabus, to be answered in 15-20 words. In addition to Question No. 1, there will be eight (08) questions, two (02) from each unit. A candidate has to answer four (04) questions, selecting at least one (01) question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours

I	A brief overview of energy mineral resources of India, sources of renewable and non-renewable energy, Importance of sustainable energy resources in the development of the country.	11
II	Coal: definition, types, coalification process, rank of coal, properties of coal: moisture, ash content, volatile matter.	11
III	Source rock, Reservoir rock, traps, migration of oil and gas, characteristics of Reservoir rocks and Cap rock, major oil and gas fields of India.	12
IV	Radioactivity and nuclear energy, important atomic minerals, their mode of occurrence and association, U and Th deposits of India. Peaceful uses of nuclear energy, nuclear environmental hazards.	11
V*	Distribution of coal, petroleum, uranium and thorium deposits of India.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory** • Class Participation: **05 marks** • Seminar/presentation/assignment/quiz/class test etc.: **05 marks** • Mid-Term Exam: **10 marks** ➢ **Practicum** • Class Participation: **NIL** • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 marks** • Mid-Term Exam: **NIL**	**End Term Examination:** **50** **20**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Economic Mineral Deposits, Bateman, A.M., Chapman and Hall.
- Ore Deposits of India, Gokhale and Rao, Thomson Press, Delhi.
- India's Mineral Resources, Krishnaswami S., Oxford & IBH.
- A Handbook of Minerals, Crystals, Rocks and Ores, Parmod, A.O., New India Publishing Agency – 2009.
- Economic Geology – Economic Mineral Deposits of India,, Prasad, U., CBS Publishers Ltd. Thermodynamics, Nordstrom, D.K. and Munoz, J.L, Blackwell.