

Programme Name/s : Mining & Mine Surveying/ Mining Engineering
Programme Code : MS/ MZ
Year : First
Course Title : ELEMENTS OF MINING GEOLOGY
Course Code : 331302

I. RATIONALE

The student of first year of Mining and Mine surveying must know basics of Geology. The knowledge of Origin of Earth, Mineralogy, and Petrology, Structural Geology including Coal Geology is included in this course. This course will help the students to identify different types of rocks, minerals and nature of strata,. The student can also identify geological features like fault and fold and prepare the geological maps of the area. This geological information will help Mining Engineer to choose appropriate method of working. The course will also provide useful information for the ground control in underground mines and slope stability in opencast mines

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to achieve the following industry identified outcome through various learning experiences: a. Implement geological knowledge in mining operations. b. Prepare structural map.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Elaborate different aspects of the earth with its origin ,interior, forces acting on it.
- CO2 - Analyze physical and chemical properties of minerals.
- CO3 - Interpret Physical Geology by natural process and earthquake , volcano.
- CO4 - Identify various types of rocks with its characteristics.
- CO5 - Interpret different geological Structures and understanding of geological maps.
- CO6 - Describe physical and chemical properties of coal with its type.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory	Based on LL & TL				Based on SL					
				CL	TL	LL						Practical				SLA					
							FA-TH	SA-TH				Total		FA-PR		SA-PR		SLA			
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min										
331302	ELEMENTS OF MINING GEOLOGY	EMG	DSC	3	-	2	1	6	6	03	30	70	100	40	50	20	25#	10	25	10	200

Total IKS Hrs for Sem. : 1 Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 30 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify given branches of Geology TLO 1.2 Illustrate given theories of origin and age of earth. TLO 1.3 Explain various layers of Interior of earth TLO 1.4 Explain specified tectonic forces acting on earth. TLO 1.5 Describe Plate Tectonics	Unit - I GENERAL GEOLOGY 1.1 Branches, sub branches, allied branches of geology and scope of geology. 1.2 Origin of earth, Age of earth 1.3 Interior of earth 1.4 Continental Drift 1.5 Plate margin, types of plate margin	Demonstration , Seminar , Case Study
2	TLO 2.1 Describe given type of minerals TLO 2.2 Identify given properties of specified minerals	Unit - II MINERALOGY 2.1 Introduction to minerals 2.2 Definition and classification of mineral. 2.3 Physical and chemical properties of minerals	Demonstration, Identification
3	TLO 3.1 Discuss given erosion and weathering process TLO 3.2 Identify the problems related with Earthquakes. TLO 3.3 Identify the problems related with volcanoes	Unit - III PHYSICAL GEOLOGY 3.1 Definition and types of erosion and weathering. 3.2 Terminology used in Earthquake. 3.3 Classification, Intensity scale, origin, effects of Earthquake. 3.4 Earthquake Resistant structures, Earthquake zones. 3.5 Volcano and its Terminologies. 3.6 Classification and product of volcano. 3.7 Volcanic structures & distribution of volcano.	Demonstration, Seminar Case ,Study
4	TLO 4.1 List various characteristics of rock types. TLO 4.2 State different types of rocks. TLO 4.3 Describe classification of given rock. TLO 4.4 Illustrate structures of specified rocks.	Unit - IV PETROLOGY 4.1 Rock cycle and characteristics of various rock types . 4.2 Igneous rock – origin and classification, structures, occurrence and uses. 4.3 Sedimentary rock– origin and classification, structures and occurrence and uses. 4.4 Metamorphic rock– origin and classification, structures, occurrence and uses.	Demonstration Identification Seminar Case Study
5	TLO 5.1 Define strike and dip. TLO 5.2 Recognize given type of folds, faults and unconformity in the field. TLO 5.3 Identify given joints and cleavages. TLO 5.4 Describe given characteristics of contour lines. TLO 5.5 Interpret given topography on the basis of contour lines.	Unit - V STRUCTURAL GEOLOGY 5.1 Strike and dip, apparent dip, True dip. 5.2 Classification of folds and its recognition in field, Classification of faults and its recognition in field, Classification and recognition of unconformity in the fields. 5.3 Joints and cleavages. 5.4 Characteristics of contour lines.	Demonstration, Seminar, Case Study ,Project

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
6	TLO 6.1 Enlist different types of coal. TLO 6.2 Identify the given properties of coal. TLO 6.3 Explain structures of specified coal seam. TLO 6.4 Describe given ranks of coal.	Unit - VI COAL GEOLOGY 6.1 Classification of coal, Origin, occurrence and distribution of coal seam. 6.2 Physical and chemical properties of various types of coal. 6.3 Rank of coal, Banded constituents of Coal.	Demonstration Seminar Case Study Project

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify various layers of Interior of Earth.	1	Draw the internal structure of Earth.	2	CO1
LLO 2.1 Understand the physical properties of minerals.	2	Identify color of given set of minerals.	2	CO2
LLO 3.1 Illustrate the physical properties of minerals.	3	Identify streak of minerals.	2	CO2
LLO 4.1 Interpret the physical properties of minerals.	4	Identify crystalline and non-crystalline forms of given set of minerals.	2	CO2
LLO 5.1 Determine the hardness of minerals.	5	Calculate Mohs scale of hardness of given specimen.	2	CO2
LLO 6.1 Illustrate the physical properties of minerals.	6	Identify lustre of metallic and nonmetallic minerals.	2	CO2
LLO 7.1 Determine the physical properties of minerals.	7	Identify various types of cleavages.	2	CO2
LLO 8.1 Understand physical properties of minerals. LLO 8.2 Understand the physical properties of minerals.	8	Identify various types of fractures.	2	CO2
LLO 9.1 Understand physical properties of minerals.	9	Identify physical properties of Quartz group minerals- Rock crystal, Amethyst, smoky, milky, rosy quartz, agate.	2	CO2
LLO 10.1 Understand the physical properties of minerals.	10	Identify physical properties of Feldspar group and Amphibole group minerals. Amphibole group: Hornblende, Actinolite, Tremolite. Feldspar Group: Orthoclase, Microcline, Albite, and Plagioclase.	2	CO2
LLO 11.1 Determine the physical properties of minerals.	11	Identify physical properties of Pyroxene group: Hypersthene, Enstatite, Augite, and Diopside. Mica group: Muscovite, Biotite, and Phlogopite.	2	CO2
LLO 12.1 Interpret the physical properties of minerals.	12	Identify physical properties of Miscellaneous Silicates Group minerals- Olivine, Garnet, chlorite, Clay, Talc, Kyanite.	2	CO2
LLO 13.1 Determine the physical properties of minerals.	13	Identify physical properties of Non Silicate Group minerals- Calcite, Dolomite, Gypsum, Fluorite, Apatite, Graphite, Corundum and Baryte.	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Understand earthquake intensity scale and types of eruptions.	14	Draw earthquake intensity scales and types of volcanic eruptions.	2	CO3
LLO 15.1 Identification of Igneous Rocks.	15	Identify physical properties of Igneous rocks-Granite, Basalt, Rhyolite, Pegmatite, Gabbro.	2	CO4
LLO 16.1 Identification of Sedimentary Rocks.	16	Identify physical properties of sedimentary rocks- Sand Stone, Breccia, Conglomerate, Shale, Limestone, Coal, Chalk, Marl, Dolomite Laterite, and Quartzite.	2	CO4
LLO 17.1 Identification of Metamorphic Rocks.	17	Identify physical properties of metamorphic rocks- Schist, Gneiss, Slate, Marble, Amphibolite.	2	CO4
LLO 18.1 Determine dip and strike of outcrop.	18	Calculate dip and strike of rock beds.	2	CO5
LLO 19.1 Interpret the profile by contour map.	19	Draw topography on the basis of contour map.	2	CO5
LLO 20.1 Understand the horizontal bedding.	20	Draw a geological section of horizontal beds.	2	CO5
LLO 21.1 Understand symmetrical anticlinal and synclinal folds.	21	Draw a geological section of symmetrical anticlinal and synclinal folds.	2	CO5
LLO 22.1 Calculation of strike and dip in faulted area. LLO 22.2 Acquire knowledge of geological structures by mapping.	22	Draw geological section of beds having normal fault by calculating stike and dip from contour line.	2	CO5
LLO 23.1 Calculation of strike and dip in faulted area. LLO 23.2 Acquire knowledge of geological structures by mapping.	23	Draw geological section of beds having reverse fault calculating stike and dip from contour line.	2	CO5
LLO 24.1 Calculation of strike and dip in faulted area. LLO 24.2 Acquire knowledge of geological structures by mapping.	24	Draw geological section of beds having vertical fault calculating stike and dip from contour line.	2	CO5
LLO 25.1 Calculation of strike and dip in faulted area. LLO 25.2 Acquire knowledge of geological structures by mapping.	25	Draw geological section of beds having inclined fault by calculating strike and dip from contour line.	2	CO5
LLO 26.1 Acquire knowledge of geological structures by mapping.	26	Draw geological section of beds having unconformity.	2	CO5
LLO 27.1 Acquire knowledge of geological structures by mapping.	27	Draw geological section of beds having double vertical fault.	2	CO5
LLO 28.1 Categorize the types coal.	28	Identify types of coal on the basis of various properties.	2	CO6

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
Note : Out of above suggestive LLOs -				
<ul style="list-style-type: none"> * Marked Practicals (LLOs) Are mandatory. Minimum 80% of above list of lab experiment are to be performed. Judicial mix of LLOs are to be performed to achieve desired outcomes. 				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Prepare a chart on Moh's scale of hardness.
- Prepare chart showing our solar system.
- Prepare a report on field visit.

Micro project

- Collect photographs and samples of minerals by visiting camp and prepare report.
- Collect different types of rocks in your vicinity.
- Prepare wooden models of fold, fault and unconformity.

Term Work

- Prepare journal of practicals.
- Group discussion on geological topics such as plate tectonics, earthquakes, volcanoes, etc.
- Prepare presentation on relevant topics.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Chart showing interior of Earth.	1
2	Wooden model of earth.	1
3	Chart of volcano and earthquake zone of India.	14
4	Hand specimen of Igneous, Sedimentary and Metamorphic rocks.	15,16,17
5	Brunton compass.	18
6	Contour maps, Topographic maps, Structural maps, drawing instruments.	19,20,21,22,23,24,25,26,27
7	Kit of various color of minerals.	2
8	Hand specimen of various types of coal.	28
9	Kit of Streak of minerals (magnifying lense, penknife and streak plates).	3
10	Kit of Forms of minerals (magnifying lense, penknife).	4
11	Kit of Moh's scale of hardness of minerals.	5
12	Kit of of lusters of minerals (magnifying lense, penknife and streak 6 plates).	6
13	Kit of fractures set (magnifying lense, penknife and streak plates).	7
14	Kit of cleavage set (magnifying lense, penknife and streak plates).	8

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
15	Hand specimens of 30 silicate and 15 non silicate group.	9,10,11,12,13

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	GENERAL GEOLOGY	CO1	16	2	4	6	12
2	II	MINERALOGY	CO2	12	2	2	6	10
3	III	PHYSICAL GEOLOGY	CO3	12	2	2	6	10
4	IV	PETROLOGY	CO4	18	4	4	6	14
5	V	STRUCTURAL GEOLOGY	CO5	20	4	4	6	14
6	VI	COAL GEOLOGY	CO6	12	2	2	6	10
Grand Total				90	16	18	36	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Mid Term Tests
- Rubrics for COs
- Assignment, Self-learning and Term Work
- Seminar/ Presentation

Summative Assessment (Assessment of Learning)

- Lab performance
- End of Term Examination
- Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3						3			
CO2	3	3		3		3	3			
CO3	3	3		3			3			
CO4	3	3		3		3	3			
CO5	3	3	2	3	2	3	3			
CO6	3	3	2	3	2	3	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	BANGAR K.M.	PRINCIPLES OF ENGINEERING GEOLOGY	Standard Publishers Distributors Delhi 2013 ISBN 13 978-8180141157

Sr.No	Author	Title	Publisher with ISBN Number
2	Parbin Singh	Engineering and General Geology	S.K. Kataria and Sons.
3	Dr.R.K. BOPACHE & Dr.D.K.AGRAWAL	GENERAL AND ENGINEERING GEOLOGY	GLOBAL EDUCATION
4	A. parthasarathy, V. Panchapakesan, R. Nagarjun	Engineering Geology	Wiley Publishing, New Delhi, 2003 ISBN : 978-8126509461
5	R.N.P Arogyaswamy	Courses in Mining Geology	CBS Publisher, ISBN 13-978-8120409378
6	G. B. Mahapatra	A Textbook of Physical Geology	CBS Publishers & Distributors, ISBN 10-8123901100

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.gsi.gov.in/webcenter/portal/OCBIS	It has reports, maps, manuals and Guidelines. Training programmes for learning.
2	https://pubs.geoscienceworld.org/	a free, public map-based toolset that allows users to search for cross sections, charts, tables, fig
3	www.geologyshop.com	printed products including maps, sheet explanations and regional guides.
4	www.geology.com	This web site has information and News about Geology and Earth Science.
5	https://www.surveyofindia.gov.in/	It is a official website of Survey of India having information about maps, mines and geological info
6	www.discovery.com	This is good for enhancing knowledge by watching few relevant programmes on Mines and Mine Survey an
7	https://youtube.com/@ExploringGeologybyGeolovers	This video is good on Exploring Geology in Hindi and information about Jobs in India.

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students