GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
I – Semester

Course Title: **Introduction to Mining & Geology**
(Course Code: 4312201)

Diploma programme in which this course is offered	Semester in which offered
Mining Engineering	First

1. RATIONALE

The Diploma holder in mining engineer will be able to define different mining operations. Mine operations include mine planning, drilling, blasting, excavation and transportation of ores. The content of this course includes basic concepts, various, rock formation their importance. Thus, this course introduces students to the mining industry. Students should therefore learn this course sincerely as a foundation course for mining industry.

2. COMPETENCY

The course should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Apply basic concepts of mining and geology in mine development, exploration and operations.**

3. COURSE OUTCOMES (Cos)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- Describe ancient mining history and also importance of mining.
- Distinguish between open cast and underground mining processes
- Differentiate between different types of Mining methods.
- Justify need and importance of geology in mining.
- Describe different geological process while formation of different types of rocks.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	0	3	30*	70	0	0	100

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	– Not Applicable-		

Note

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

*ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..*

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED – (Not Applicable)

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	**– Not Applicable-**	

7. AFFECTIVE DOMAIN OUTCOMES

The following Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfil the development of this course competency.

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Practice environmental friendly methods and processes in Mining. (Environment related)

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit – I **Mining History**	1a. Explain History of Mining. 1b. Describe need and importance of mining. 1c. List different approach in Mining industry. 1d. Describe impact of Mining Industry.	1.1 Ancient history & origin of mining and its need. 1.2 Different civilization and their approach towards mining. 1.3 Commencement of mining in India 1.4 Indian Mining Industry. 1.5 Importance of Mining-Socially and economically
Unit – II **Mining Termino-logy**	2a. Explain basic terminology used for Mining. 2b. Describe different Opencast Mining terminology. 2c. Explain important Underground Mining terminology.	2.1 Define- Mine, Mining, Ore, rock, Mineral, Gangue, gangue mineral Coal, Bed, Strata, Deposits-Vein deposit, Stratified deposit, massive deposit. &outcrop deposits 2.2 Open cast mining terminology-Overburden rock, mineral bed, top soil, stripping ratio, box-cut, bench formation, waste dump & mine sump, 2.3 Underground Mining terminology-Approach mode-(incline, shaft & adit) Level, dip, rise, strike, pillar, roof, floor, goaf, face, haulage & fan ventilation.
Unit– III **Types & Stages of Mining**	3a. List different types of Mining 3b. Differentiate between different Mining methods. 3b. Describe stages of Mining. 3d. Justify the use of Mine reclamation.	3.1 Types of Mining- Opencast Mining, Underground mining, Placer mining, In-situ leaching & High wall mining. 3.2 Stages of Mining- Prospecting, Exploration, Excavation and Reclamation & Rehabilitation. 3.3 Importance of Mine reclamation.
Unit– IV **Importance of Geology**	4a. Describe origin of The Earth 4b. Explain need and importance of Geology. 4c. Justify the use of geology in Mining Industry. 4d. List the importance of geologist in mining industry.	4.1 History of Geology-Origin of Earth. Theories for origin of Earth-the nebular hypothesis & the tidal hypothesis. 4.2 Benefits of geology in Mining Industry. 4.3 Role of geologist in Mining Industry.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit– V **Geological Terminology and Rocks**	5a. Describe geological features. 5b. Illustrate basic geological features. 5c. List different types of rock 5d. Explain formation of different types of rocks.	5.1 Geological features- Fold- anticline & syncline, fault, joints, dyke, sills. 5.2 Sedimentary rock, Igneous rock and metamorphic rock with example. 5.3 Basis formation process of rocks.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
I	Mining History	10	04	07	05	16
II	Mining Terminology	09	04	06	06	16
III	Types &Stages of Mining	09	04	07	04	15
IV	Importance of Geology	06	03	04	03	10
V	Geology Terminology	08	04	05	04	13
Total		**42**	**19**	**29**	**22**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Note*: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Prepare specification table for different types of minerals and rocks.
b) Undertake micro-projects in teams
c) Give seminar on any relevant topic.
d) Prepare showcase portfolios.
e) Prepare report on various issues related to mining activity.
f) Publish a research paper on themes related to mining advancement.
g) Undertake some small mini projects on various issues related mining industry.
h) Submit a report on visit to a geological site.
i) Prepare power point on social and economical impact due to mining
j) Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No.4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Arrange visit to nearby industries and workshops for understanding mining activity.
g) Use video/animation films to explain various processes related to mining operation.
h) Use different instructional strategies in classroom teaching.
i) Write the report on properties of different rock and minerals.
j) Display various technical brochures of recent projects/themes related to mining industry.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the microproject should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Build a Chart showing advancement in mining activity
b) **Open cast mining:** Build a model of opencast mining
c) **Underground Mining:** Build a model of underground mining.
d) Surf different websites related to new coming technologies in mining industry.
e) Prepare report visit to mine site and geological site.
f) Visit to nearby mine site and study various aspects related to environment and sustainable development

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Elements of Mining Technology part I , II and III	D. J Deshmukh	Central Techno Publication Latest Edition ISBN -9788189904333
2	A Text book of Geology	G.B Mahapatra	CBS Publishers and Disyributors Pvt. Ltd. ISBN-9788123900131
3	Engineering & General geolgy	Parbin Singh	S.K Kataria & Sons ISBN- 9788188458516
4	Surface Mining Technology	S. K Das	Sagardeep Prakashan, Kharagpur ISBN- 9789811635687

14. SOFTWARE/LEARNING WEBSITES

- https://en.wikipedia.org/wiki/Mining.
- http://geology.com/
- http://emg.geoscienceworld.org/content/current
- http://en.wikipedia.org/wiki/Mineral_exploration
- https://nptel.ac.in/courses/123/105/123105007/

15. PO-COMPETENCY-CO MAPPING

Semester I	Introduction to Mining & Geology (Course Code: 4312201)								
	POs and PSOs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ develop-ment of solutions	PO 4 Engineering Tools, Experiment ation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Manage-ment	PO 7 Life-long learning	PSO 1 Environ-mental planning & design	PSO 2 Execution & Mainten-ance
Competency - Adopt the sustainable practices to resolve the environment related issues									
a. Describe ancient mining history and also importance of mining	2	1	-	-	2	-	1	-	-
b. Illustrate basic terms used in Mining.	2	-	1	-	-	-	1	-	-
c. Differentiate between different types of Mining methods.	2	-	2	-	1	-	1	-	1

d. Explain need and importance of geology in mining	2	-	-	1	2	-	1	-	-
e. Describe different geological process and also formation of different types of rocks	2	-	2	1	1	-	1	1	1

Legend: '**3**' for high, '**2**' for medium, **'1'** for low and **'-'** for no correlation of each CO with PO/PSO.

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

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