GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2022
Semester-IV

Course Title: Mine Machineries-II
Course Code: 4342202

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

1. RATIONALE

The mining engineers are generally responsible for the mine developments, mining activities Supervision etc. In this process they have to use different machines and hence are expected to know about all types of machinery used in mining industries and their applications, operational parameters, safety features etc. The course provide students basic knowledge and skill about various types of ropes ,winding system, u/g machineries, loading and hauling machine, hoisting machine and various safety devices used in mines their installation operation and safety feature of all the machines.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills so that student is able to acquire following competency.

- **Supervise appropriate and safe use and maintenance of different underground mining machinery.**

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:

CO1: Select suitable machineries for underground workings depending upon restricted space condition and working principle.
CO2: Achieve optimum utilization of all underground machineries.
CO3: Justify the output given by machine during underground working.
CO4: Design a work layout for various underground machineries.
CO5: Illustrate the factors influencing the performance of underground machines.

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	-	2	4	30	70	25	25	150

(*): 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. *Some of the* ***PrOs*** *marked* ***'*'*** *are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Calculate production and number of machines required by observing the work cycle of Continuous Miner with Shuttle Car.	II	04
2	Calculate number of drill holes and drill jumbo machine required by observing its work cycle.	I	04
3	Calculate production and number of machines required by observing the work cycle of Shearer with AFC.	I	04
4	Calculate production and number of machines required by observing the work cycle of Rocker Shovel.	II	05
5	Design a suitable shape of a Winding Drum showing all its constructional feature for varying depths and torque requirement conditions.	III	05
6	Design a suitable Pit Top & Pit Bottom circuit layout used for Cage winding system depending upon various space limitations.	III	06
		Total	**28**

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

This 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.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	• Continuous Miner & Armored Face Conveyer. • Shearer models • Rocker Shovel models • Shovel models. • Winding Drum models. • Winding Engine Brake model. • Safety Hook model. • Different Pit-top and pit-bottom Layout models.	1-5

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
	• Wire Rope Sample. • Demonstration model of Rope Splicing System.	

7. AFFECTIVE DOMAIN OUTCOMES

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

a) Work as a team member/ individual.
b) Follow ethical practices.
c) Follow safe practice on site.
d) Practice of environmental friendly methods and processes.

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

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I: Underground Coal Mining Face Machineries	1. Describe the Purpose and Working principles of various types of Underground Coal Mining Machineries	Construction & Operation of Underground Coal Mining Machines: 1. Coal Drills 2. Continuous Miner 3. Shearer 4. Armored Face Conveyor
Unit – II: Underground Metal Mining Face Machineries	2. Describe the Purpose and Working principles of various types of Underground Metal Mining Machineries.	Construction & Operation of Underground Metal Mining Machines: 1. Jack Hammer 2. Stoper 3. Single and Double Boom Drill Jumbo 4. Low Profile Dump Truck (LPDT)
Unit – III : Mechanical Loaders	3. Describe various types of Loading and Hauling Machines used in Underground Mine	Construction, Operation & Application of following Machineries: 1. Rocker Shovels 2. Gathering Arm Loader 3. Scrapper 4. Load Haul and Dump Machines 5. Shuttle Car.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – IV : Hosting Machineries	4a. Explain main working Components of Hoisting and Transport System. 4b.Follow Safety Measures to Operate Hoisting and Transport System.	4.1 Shaft Equipment, Headgear: Purpose, Height of Headgear, Design, Headgear Pulley 4.2 Cages & Cage Accessories Constructional features of Winding Drum, Detaching Hook, Distributing Plate, Cage Chain, Safety Catches, Shock Absorbers, Keps 4.3 Skip Winding: Type of Skips, Advantages and Disadvantages, Applicability Conditions. 4.4 Winding Engines: Winder, Winding Drums, Types of Winding, Winding Engine Brakes. 4.5 Shaft Guides: Rigid & Rode type 4.6 Multi-rope Winding, Advantages & Disadvantages 4.7 Pit Top and Pit Bottom Circuits.
Unit – V : Wire Ropes	5. Explain Manufacturing, Types, Splicing, Capping, and Load Calculations of Wire Ropes.	5.1 Wire Rope: Selection, Material of Construction, Tests, Factor of Safety, Types 5.2 Use and Care of Wire Ropes 5.3 Rope Capping, Rope Splicing 5.4 Calculation based on Wire Rope.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Underground Coal Mining Face Machineries	04	04	02	02	08
II	Underground Metal Mining Face Machineries	04	04	02	02	08
III	Mechanical Loaders	06	06	03	03	12
IV	Hosting Machineries	16	10	06	06	22
V	Wire Ropes	12	10	04	06	20
Total		**42**	**34**	**17**	**19**	**70**

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

Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions 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 vary slightly 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 conduct following activities in group and prepare reports of about 5

pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Visit a mining site and collect working data to study the project.
b) Prepare visit report with detail data of particular mine.
c) Undertake micro-project.
d) Make power point presentation on particular visit in group.
e) Give presentation on relevant topic.

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) Guide students on how to address issues on environment and sustainability

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 total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student 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:

1. Prepare a chart sheet of various machineries used in mines with their photographs and their details shown in sheet.
2. Prepare presentation lecture on the particular chart sheet.
3. Model: Prepare a model of any one machinery.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Mine Pumps and Haulages	S. Ghatak	Lovely Prakashan Dhanbad
2	Elements of Mining Technology Volume-3	D. J. Deshmukh	Lovely Prakashan Dhanbad
3	U.M.S		Lovely Prakashan Dhanbad

14. SOFTWARE/LEARNING WEBSITES

1. http://www.joy.com/
2. NPTEL lecture series on Mining Machinery: https://archive.nptel.ac.in/courses/123/105/123105005/
3. http://en.wikipedia.org/wiki/Underground_mining_(hard_rock)
4. http://www.mtu-online.com/mtu/applications/mining/underground- mining-machines/
5. http://www.greatmining.com/Underground-Mining.html

15. PO-COMPETENCY-CO MAPPING

Semester IV	Mine Machineries-II (Course Code: 4342202)								
	POs and PSOs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1 Student will be able to operate flame safety lamp effectively.	PSO 2 Student will be able to test percentage of inflammable gas.
Competency	**Supervise appropriate and safe use and maintenance of different underground mining machinery.**								
Course Outcomes **CO1:** Select suitable machineries for underground workings depending upon restricted space condition and working principle.	3	-	-	-	-	-	2	-	-
CO2: Achieve optimum utilization of all underground machineries.	3	2	-	2	-	-	-	-	-
CO3: Justify the output given by machine during underground working.	3	2	-	3	-	-	-	-	-
CO4: Design a work	3	3	-	2	-	-	-	-	-

layout for various underground machineries.									
CO5: Illustrate the factors influencing the performance of underground machines.	3	3	-	2	-	-	-	-	-

Legend: '**3'** for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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