



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mining Engineering

Subject Code: DI04022101

Subject Name: Mine Electrical Engineering

<b>w. e. f. Academic Year:</b>	2025-26
<b>Semester:</b>	4 <sup>th</sup>
<b>Category of the Course:</b>	Professional Elective - II

<b>Prerequisite:</b>	Students should have a basic introduction to mines and mining machinery, along with fundamental knowledge of physics and mathematics. This foundation will enable them to understand applications of electrical systems in mining.
<b>Rationale:</b>	This subject provides mining diploma students with essential knowledge of electrical engineering concepts and their specific applications in mines. It emphasizes safe use of electrical equipment, lighting, signaling, switchgear, cables, and distribution systems. The aim is to build competency for operating, maintaining, and ensuring safety of electrical systems in mining operations.

## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply fundamentals of basic electrical quantities in engineering applications.	R, U, A
02	Describe electrical equipment used in mines and their safety features.	R, U
03	Explain lighting and signaling systems used in mining operations.	R, U, A
04	Demonstrate types, operation, and maintenance of switchgear and cables in mines.	R, U
05	Apply electrical distribution and safety practices in mining operations.	R, U, A

\*Revised Bloom's Taxonomy (RBT)

## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2) C	Assessment Pattern and Marks				Total Marks
L	T	PR		Theory		Tutorial / Practical		
			ESE (E)	PA (M)	PA (I)	ESE (V)		
3	0	2	4	70	30	20	30	150



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>Unit 1: Fundamentals of Electrical Engineering</b> 1.1 Basic Electrical Quantities 1.1.1 Electric Potential 1.1.2 Potential Difference 1.1.3 Electromotive Force (EMF) 1.1.4 Electric Current 1.1.5 Resistance 1.2 Ohm's Law 1.3 Resistors in Series and Parallel 1.4 Concept of AC (Alternating Current) and DC (Direct Current) 1.5 Three-Phase Power Generation - Importance and Applications 1.6 Principle of Operation and Constructional Features of Motors and Generators	09	20%
2.	<b>Unit 2: Electrical Equipment in Mines</b> 2.1 Intrinsically Safe Equipment in Mines 2.2 Pilot Circuits -Advantages and Applications 2.3 Gate-End Box - Constructional and Safety Features 2.4 Flame-Proof Equipment 2.4.1 Flame-Proof Enclosure - Purpose and Applications 2.4.2 Construction of Flame-Proof Enclosures	09	20%
3.	<b>Unit 3: Illumination and Signalling in Mines</b> 3.1 Lighting in Mines 3.1.1 Portable Lamps 3.1.2 Charging of Batteries 3.2 Signalling Systems in Mines 3.2.1 Shaft Signalling 3.2.2 Rope Haulage Road Signalling	09	20%
4.	<b>Unit 4: Switchgear and Cables in Mines</b> 4.1 Switchgear in Mining Applications 4.1.1 Types of Switchgear 4.1.2 Circuit Breakers - Principles and Applications 4.1.3 Arc Control and Arc Suppression Techniques a) Oil Circuit Breakers (OCB) b) Air Circuit Breakers (ACB) c) SF <sub>6</sub> Circuit Breakers d) Vacuum Circuit Breakers 4.1.4 Maintenance of Switchgear	09	20%



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	4.2 Cables in Mines 4.2.1 Types of Cables Used in Mines 4.2.2 Maintenance of Cables 4.2.3 Fault Finding in Cables		
5.	<b>Unit 5: Electrical Distribution and Safety in Mines as per CEA Safety Regulation, 2010</b> 5.1 Electrical Distribution Systems in Mines 5.1.1 Distribution Schemes for Open-Cast Mines 5.1.2 Transmission and Distribution of Power in Mines 5.2 Electrical Safety in Mines (as per CEA Safety Regulations, 2010) 5.2.1 Responsibilities for Electrical Safety and Mine Plans 5.2.2 Lighting, Overhead Lines, and Fire Precautions 5.2.3 Voltage Limits and Safe Operation of Equipment 5.2.4 Cables a) Cables in Mines b) Flexible Cables 5.2.5 Precautions in Hazardous Environments a) Safety in Gassy Mines (Firedamp, Methane) b) Shot-Firing and Electrical Safety in Blasting 5.2.6 Electrical Supervision Requirements in Mines	09	20%
	<b>Total</b>	<b>45</b>	<b>100</b>

### Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
34	46	20	00	00	00

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

### References/Suggested Learning Resources:

#### (a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Basic Electronics and Linear Circuits	Bhargava N.N., Kulshreshtha D.C. and Gupta S.C.	McGraw Hill Education, New Delhi, ISBN: 9780074519653



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Sr. No.	Title of Book	Author	Publication with place, year and ISBN
2	A text book of Electrical Technology-Vol.1	Theraja B. L. Theraja A.K.	S. Chand Publication ISBN: 9788121924375
3	Electrical Engineering in Mines	Nil K. Datta	New Central Book Agency (P) Ltd ISBN: 8173811490
4	Electrotechnology in Mining	N. Marinovic	Elsevier Science, ISBN: 9780444564627
5	Electricity For Mine Engineers	P.K. Chakrabati, Biren Mukerjee	Medtech Publishers, ISBN: 9789386479150

## (b) Open-source software and website:

1. Analog Devices, "LTspice Simulator," *Analog.com*. : <https://www.analog.com/en/resources/design-tools-and-calculators/ltspice-simulator.html>
2. KiCad Project, "KiCad EDA," *Kicad.org*. : <https://www.kicad.org/>
3. Scilab Enterprises, "Scilab: Free and Open Source Software for Numerical Computation," *Scilab.org*. : <https://www.scilab.org/>
4. Open Source Modelica Consortium, "OpenModelica," *Openmodelica.org*. : <https://openmodelica.org/>
5. SourceForge, "Qucs: Quite Universal Circuit Simulator," *Qucs.sourceforge.net*. : <http://qucs.sourceforge.net/>
6. EETech Media, "All About Circuits," *Allaboutcircuits.com*. : <https://www.allaboutcircuits.com/>
7. Electronics-Tutorials, "Electronics Tutorials," *Electronics-tutorials.ws*. : <https://www.electronics-tutorials.ws/>
8. Directorate General of Mines Safety (DGMS), "DGMS Official Portal," *dgms.gov.in*. : <https://www.dgms.gov.in/>
9. Central Electricity Authority (CEA), "CEA Official Portal," *cea.nic.in*. : <https://cea.nic.in/>
10. International Labour Organization, "Safety and Health at Work," *ILO.org*. : <https://www.ilo.org/global/topics/safety-and-health-at-work/lang--en/index.htm>
11. University of Colorado Boulder, "PhET Interactive Simulations," *Phet.colorado.edu*. : <https://phet.colorado.edu/>



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## Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify resistors, inductors, and capacitors in the lab, and verify Ohm's Law in a DC circuit.	I	6
2	Draw the schematic diagram of a pilot circuit and a Gate-End Box, and explain their working principles.	II	8
3	Draw the layout of a shaft signaling system and rope haulage signaling, and explain their working principles.	III	4
4	Determine the suitable type of circuit breaker for a given mine electrical operating conditions.	IV	4
5	Draw a line diagram showing the usual arrangement of feeders and transformers for power distribution in a mine, and explain the flow of electrical power from source to loads.	V	8
			<b>30 Hrs.</b>

## Suggested Project List:

1. Build a working signaling model for shaft or haulage communication.
2. Fabricate a scaled model of flame proof enclosure showing constructional and safety features.
3. Prepare a poster showing types of electrical equipment used in mines (intrinsically safe, flame-proof, portable lamps, etc.).
4. Prepare an illustration banner showing constructional features of a Gate-End Box.
5. Presentation on a case study related to electrical accidents in mines and their preventive measures.
6. Prepare a poster showing cable types and their applications in mines.
7. Make slides demonstrating arc suppression methods in different circuit breakers.
8. Design a layout diagram of an electrical distribution system in an open-cast mine.
9. Prepare a chart showing the battery charging process and maintenance steps of a cap lamp.
10. Prepare a sheet showing signaling arrangements in shaft and rope haulage systems.



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11. Prepare a presentation on CEA Safety Regulations (2010) relevant to mining electrical safety.

## **Suggested Activities for Students:**

1. Visit a nearby mine to study electrical distribution and safety practices.
2. Attend an expert lecture on power distribution and safety in mines.
3. Take part in online course on circuit designing software, simulation tools.
4. Participate in a quiz competition related to electrical safety regulations and equipment in mines.
5. View online videos showing operation of circuit breakers, flame-proof enclosures, and cable fault detection.
6. Conduct a group discussion on electrical hazards and accident prevention measures in mining.
7. Undertake a micro project on lighting, signaling, or cable fault testing in mining applications.

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