GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Mining Engineering
Subject Code: BE04022021
Subject Name: Mine Surveying - I

w. e. f. Academic Year:	2024-25
Semester:	4
Category of the Course:	Professional Core Course

Prerequisite:	Mechanics of Solids
Rationale:	Mine Surveying – I introduces the foundational principles and techniques of surveying essential for mining engineers. The course emphasizes the accurate measurement, mapping, and correlation of surface and underground workings, integrating traditional methods with modern technologies, such as Total Stations and GPS, to support safe and efficient mine planning and operations.

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Explain the principles and importance of mine surveying in mining operations.	08
CO-2	Perform linear and angular measurements using traditional and modern instruments.	18
CO-3	Conduct levelling and contouring surveys and prepare plans and sections.	18
CO-4	Apply traversing and correlation methods for surface and underground connections.	18
CO-5	Analyze and interpret mine plans, working plans, and survey data to inform operational decisions.	08

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	SL	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/CA (I)	TW/ SL (I)	ESE (V)	
45	0	30	45	120	4	70	30	20	30	50	200

Content:

Sr. No.	Content	Total Hrs
1	**Fundamentals of Mine Surveying** Definition, objectives, and scope of mine surveying; Classification of surveys – surface, underground, and special surveys; Duties and responsibilities of mine surveyors under statutory provisions; Units of measurement, scales, bearings, meridians and conventions used in mine plans; Errors in surveying and their adjustments.	06

2	**Linear and Angular Measurements** Measurement of distances – chain, tape, and electronic distance measurement (EDM); Corrections to measured lengths – temperature, tension, sag, and slope corrections; Compass surveying – types of compasses, bearing systems, local attraction, and adjustments; Theodolite – types, parts, adjustments, temporary and permanent settings; Measurement of horizontal and vertical angles; computation of bearings and coordinates.	**07**
3	**Levelling and Contouring** Principles of levelling, types of levels, and levelling staff; Methods of levelling – differential, reciprocal, fly, and check levelling; Booking and reduction of levels – rise and fall method, height of collimation method. Contouring – characteristics, methods of contouring, and interpretation of contour maps; Applications of levelling and contouring in mining.	**10**
4	**Traversing and Plan Preparation** Plane table surveying – instruments, methods, and errors. Traversing – methods of conducting closed and open traverses. Adjustment of traverses – graphical and mathematical methods. Plotting of traverses, computation of coordinates, area calculation. Preparation and interpretation of mine plans and sections; use of CAD for mine plans.	**12**
5	**Modern Surveying Techniques** Total Station and GPS surveying – principle, components, and applications in mining; Introduction to Total Station, GPS, and Drone-based mine surveys; Basics of photogrammetry, remote sensing, and GIS applications in mine surveying.	**10**
	TOTAL	**45**

Suggested Specification table with Marks (Theory): (For B.E. only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	**40**	**10**	**10**	**00**	**00**

R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Surveying	Bannister, A., Raymond, S., & Baker, R.	Prentice Hall 0582302498 978-0582302495
2.	Engineering Surveying	W. Schofield	Butterworth-Heinemann 3rd Edition, 2013 9781483105130
3.	Mine Surveying, Volume I	S. Ghatak	Lovely Prakashan
4.	Surveying Vol. I	B.C. Punmia , Ashok Kumar Jain, Arun Kumar Jain	Laxmi Publications Seventeenth edition 9788170088530 978-8170088530
5.	Surveying & Levelling Vol - I	T.P. Kanetkar and S. V. Kulkarni	Pune Vidyarthi Griha Prakashan 1st Edition,Reprint 2017 9788185825114

List of Experiments:

i. Study of mine surveying instruments (compass, theodolite, level, plane table).
ii. Measurement of distance using a chain and tape with correction.
iii. Compass surveying – measurement of bearings and plotting.
iv. To study and perform the horizontal angle measurements.
v. To study and perform the differential and reciprocal levelling.
vi. To study and perform the plane table surveying by radiation and intersection methods.
vii. To study and perform closed traverse – computation and adjustment of errors.
viii. Demonstration of Total Station and GPS-based surveying.

Major Equipment:

i. Total Station
ii. Drone
iii. Theodolite
iv. Dumpy Level
v. Plane Table
vi. Magnetic Compass
vii. Miners' Dial
viii. GPS
ix. Planimeter,
x. Clinometers,
xi. Box sextant,
xii. Line ranger,
xiii. Optical prism,

xiv. Abney level
xv. Resistive Potentiometer, Tachometers, Piezoelectric Accelerometer

List of Open-Source Software/learning website:

i. http://surveying2012.blogspot.in/2013/08/tacheometry-surveying.html
ii. http://nptel.ac.in/courses/105107122/modules/module11/html/38-4.htm
iii. http://nptel.ac.in/courses/105107122/modules/module11/html/39-10.htm
iv. https://nptel.ac.in/courses/105107218
v. https://www.youtube.com/watch?v=4_LAmovSkRc

List of suggested activities for Problem Based Learning:

a. **Assignments**: (Seminar Topics/ Visits/Self-Learning Topics) Questions/Problems/Numerical/Exercises to be provided by the course teacher in line with the targeted COs.)

i. Solve numerical problems on corrections to measured distances for slope, temperature, tension, and sag.
ii. Prepare a computation sheet using both the rise and fall and height of collimation methods from raw field data.
iii. Compute included angles, bearings, coordinates, and closing error from given traverse data.
iv. Prepare a mine surface plan using given data (manual or CAD software).
v. Document temporary and permanent adjustments of major instruments (Theodolite, Level, Compass).
vi. Prepare a short report on “Evolution of Surveying Instruments from Chain to GPS”.
vii. Prepare a presentation on modern surveying technologies such as Drone Mapping, LiDAR, or 3D Mine Modeling.

b. **Micro Projects: A** Suggested list of course-wise micro-projects is mentioned herewith

i. Visit a nearby opencast mine to observe practical applications of surveying and data recording.
ii. Attend a guest lecture/webinar by a professional mine surveyor or DGMS official on digital mine surveying and compliance.

****