GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Mining Engineering
Subject Code: BE05022011
Subject Name: Mine Surveying - II

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Core Course

Prerequisite:	Mine Surveying – II
Rationale:	This course provides knowledge of advanced mine surveying techniques used in underground and surface mining operations. The course covers correlation surveying, curve ranging, subsidence surveys, photogrammetry, mine plans, and DGMS regulations, enabling students to perform accurate surveying, mine mapping, planning, monitoring, and statutory compliance in mining engineering.

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Explain the principles and importance of curve surveying in mining operations.	15
CO-2	Perform correlation and alignment transfer between surface and underground workings.	30
CO-3	Apply tacheometric surveying methods for distance, elevation, and contour determination.	20
CO-4	Apply photogrammetry techniques for aerial mapping, contouring, and image interpretation in surveying applications.	20
CO-5	Prepare and interpret mine plan and sections as per the statutory and geological requirements.	15

Teaching and Examination Scheme:

Teaching/Learning Scheme in hrs/semester					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Practical			
L	T	P	PBL*	TH	TH/30	ESE (E)	PA (M)	PA (I)	PBL(I)	ESE (V)	
45	0	30	45	120	4	70	30	20	30	50	200

Content:

Sr. No.	Content	Total Hrs.
1	**Curve Ranging** Introduction, Necessity, classification, Designation, Elements of simple curve, Principles, Methods of curve ranging and curve setting methods, Obstacles in Curve Ranging, Errors in Curve Setting and Precautions, Field Procedure for Curve Alignment, Applications of curves in the field, Numerical problems and modern instruments used in curve surveying.	**06**
2	**Correlation surveying** Introduction to correlation surveying, objectives and importance of correlation in mining, necessity of establishing relationship between surface and underground workings, methods of correlation through single shaft, two shafts, adits and inclines, shaft plumbing methods, use of plumb wires, Weisbach triangle method, Weisbach quadrilateral method, transfer of bearing, alignment, coordinates and levels from surface to underground, gyroscopic surveying, errors in correlation surveying, precautions during shaft correlation, modern techniques using EDM, Total Station, laser alignment and digital surveying instruments.	**07**
3	**Tacheometric surveying:** Principles and methods of tacheometry, stadia system of surveying, fixed and movable hair methods, determination of horizontal distance and elevation by stadia method, tangential tacheometry, instrumental constants, anallatic lens, reduction of observations, field procedures and computations, applications of tacheometric surveying in topographic mapping, contouring, route alignment, hydrographic and mining surveys, advantages, limitations and sources of errors in tacheometric measurements.	**10**
4	**Photogrammetry:** Introduction, principles and applications, types, scales, vertical and oblique photographs, photographic geometry, stereoscopic vision and stereoscopes, parallax and height determination, aerial survey planning, ground control and flight planning, preparation and interpretation of photomaps and mosaics, contour mapping using aerial photographs, digital photogrammetry, image interpretation techniques.	**12**
5	**Subsidence Surveying:** Introduction, concept and causes, objectives and importance, types of ground movement and deformation, factors affecting subsidence, subsidence prediction methods, establishment of surface and underground control stations, instruments used in subsidence surveying, measurement of vertical and horizontal displacement, DGMS regulations and statutory provisions related to subsidence surveying. **Mine Plans and Sections:** Legal requirements, preparation and preservation of it; Representation of geological features in it, its symbols. Enlargement of plans and tools used for it, Mine Models.	**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.

The syllabus of Mine Surveying – II directly contributes to

SDG 4	Quality Education
SDG 8	Decent work and Economic growth
SDG 9	Industry Innovation and Infrastructure
SDG 12	Responsible consumption
SDG 13	Climate action
SDG 15	Life of Land

Reference Books:

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

List of Experiments:

i. Study of different methods of curve ranging and setting out of simple circular curves.
ii. Determination of tangent length, deflection angle, chainage, and curve elements in railway/highway curves.
iii. Correlation survey between surface and underground workings using the shaft plumbing method.
iv. Establishment of underground traverse by correlation survey using weisbach triangle method.
v. Determination of horizontal distance and elevation by tacheometric survey using the stadia method.
vi. Preparation of a contour map of a given area using tacheometric surveying techniques.
vii. Study and interpretation of aerial photographs for mine planning and mapping.
viii. Determination of ground features and height measurements using photogrammetric techniques.
ix. Measurement and Monitoring of Surface Subsidence over Underground Mine Workings.
x. Preparation and Analysis of Subsidence Profile and Subsidence Prediction for Mining Areas.

Major Equipment:

i. Total Station
ii. Global Positioning System (GPS)
iii. Drone
iv. GIS applications in mining
v. Digital mine mapping software
vi. Introduction to LiDAR

List of Open-Source Software/learning website:

i. https://www.youtube.com/watch?v=7UhaCqea7IY
ii. https://www.youtube.com/results?search_query=Correlation+surveying
iii. https://www.youtube.com/watch?v=ElV0rQ4n4XM
iv. https://www.youtube.com/watch?v=tj3h1kSGz58&list=PLwdnzlV3ogoXXrcA8w6rrYmXfq3uU4R7g&index=16&pp=iAQB
v. https://www.youtube.com/watch?v=oGjUWKSmf2w

List of suggested activities for Problem-based Learning (PBL):

Sr. No.	PBL category	Name of the activity	No. of hours	Evaluation Criteria
1.	Complex Problem-Solving targeting relevant SDGs / Mini Project	Mini Project	10h (need to be changed as per total PBL hours)	Based on the novelty of project, technical understanding, report quality and presentation

2.	Case Study Analysis / Seminar	Seminar	15h (need to be changed as per total PBL hours)	Based on the quality of report and presentation, technical understanding
3.	Micro project	Micro project	5h (need to be changed as per total PBL hours)	Based on the novelty of project, technical understanding, quality of report and demonstration
4.	Industry/Research laboratory visit	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
5.	Video Based Learning	Technical video-based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
6.	Assignment / Technical Writing / Research Writing	Assignment writing. Numerical based assignment is preferable.	5 assignments of 4 h each Total = 20h	Based on the correctness of submitted assignment
7.	Group Discussion / Quiz / Simulation	Problem solving/Coding using C, C++, MATLAB, Python, SCILAB, modeling and Analysis software or any other software	5 small coding-based assignment of 2h each Total = 10h	Based on the coding solution submitted.
8.	Video Based Learning	Self-learning online course	Minimum duration of the course should be 10h	Examination based assessment at the end of course. Based on the certificate produced.
9.	Complex Problem-Solving targeting relevant SDGs / Mini Project	Identification and solution of Complex problem	Maximum 2 problems. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
10.	Video Based Learning	Videos on Industrial safety/Disaster Management aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
11.	Research Paper Review / Analysis	Technical paper reading and summarization of research papers based on relevant subject	5 research papers = 20h	Summarize research paper and evaluation critical parameters
12.	Poster / Chart / PowerPoint	Poster/chart/power point preparation on technical	Duration = 6h	Based on poster/chart preparation and

	presentation	topics		presentation skills
13.	Industry/Research laboratory visit	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/sustainability/any other issue	Duration = 15h for industrial exposure Problem identification and tentative solution = 10h Total = 20h	Based on evaluation of critical problems and solutions
14.	Group Discussion / Quiz / Simulation	Group Discussion on emerging/trending technical topics based on subject	Duration = 1h – 3h per topic	Based on performance in group discussion, technical depth, knowledge etc.
15.	Case Study Analysis / Seminar	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
16.	Group Discussion / Quiz / Simulation	Application/Software development	Duration = 10h	Depending on the complexity of the Application/Software
17.	Assignment / Technical Writing / Research Writing	Research paper publication	Duration = 10h	Based on submission of proof of publication
18.	Micro project	Upgradation/Reverse engineering studies of existing equipment of the laboratory	Duration 10h	Based on the performance of the equipment
19.	Industry/Research laboratory visit	Expert lecture/session	Duration 3h For attending the lecture/session– 2h and for report writing 1h	Based on the proof of attendance and report submitted
20.	Video Based Learning	Annotated Video Explanation of Concept/Problem	10h (Preparation + Recording + Submission)	Based on accuracy of explanation, clarity, and presentation style.
21.	Assignment / Technical Writing / Research Writing	Patent Search and Innovation Gap Identification	10h (Search + Report)	Based on number of relevant patents analyzed and identification of innovation scope.
22.	Assignment / Technical Writing / Research Writing	Preparation of a report on Indian Standard(s)	10h (study of Indian Standard(s) + report	Based on report quality and understanding of the relevant Indian Standard(s).

List of suggested activities for Term Work / Self 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. Study and explain the methods of correlation surveying in underground mines.
ii. Solve numerical problems related to curve ranging and curve setting.
iii. Prepare detailed notes on shaft plumbing and the Weisbach triangle method.
iv. Prepare a report on photogrammetry and drone surveying in mining.
v. Study DGMS regulations related to mine plans and statutory surveys.
vi. Calculate traverse adjustment and coordinate correction problems.
vii. Prepare contour maps and mine layouts using survey data.
viii. Write short notes on subsidence surveying and deformation monitoring techniques.

b. Micro Projects:

A Suggested list of course-wise micro-projects is mentioned herewith

i. Preparation of mine plans and sections using AutoCAD software.
ii. Curve ranging and alignment survey for mine haul roads.
iii. Correlation survey model using the Weisbach triangle method.
iv. GPS-based mine boundary survey and coordinate plotting.
v. Subsidence monitoring and deformation analysis of mining area.
vi. Drone/UAV survey for quarry mapping and volumetric estimation.
vii. Digital contour map preparation using survey data.

Note:

1. Mini Project – 10 Marks , Micro Project – 5 Marks
2. The hours allocated to specific activities should be proportionate to the total no. of PBL hours and marks.

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