

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)

Semester - III

Course Title: Mine Surveying - I (Course Code: 4332203)

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

1. RATIONALE

The diploma holders in mining engineering are generally responsible for the mine developments. Being Mining Engineers, they must be able to understand and identify various features of mining field from mine plans, sections and predict future course of actions. The important matter in this course content is the theory and practical related to prepare plans, layouts, sections, topo sheets etc. and make them interpret as well. In this course one must give the maximum emphasis on learning by doing the practical part mainly the field exercises.

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:

- Survey and prepare drawings and interpret various mine plans and sections for mining 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:

CO1: Operate and adjust theodolite.

CO2: Apply all checks needed to adjust traverse survey.

CO3: Prepare contour map of various land by using level.

CO4: Demonstrate fault, subsidence and depth measurement survey.

CO5: Measure direction and inclination of underground roadways.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	CA	ESE	CA	ESE	
4	-	4	6	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 – Not Applicable

The following practical outcomes (PrOs) that 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	Perform temporary adjustments of theodolite and measure horizontal and vertical angle.	I	10
2	Perform Closed traverse survey by theodolite and draw sheet.	II	10
3	Perform Open traverse survey by theodolite and draw sheet.	II	10
4	Determine reduced level of various location using Height of Instrument method by applying checks.	III	08
5	Determine reduced level of various location using Rise and Fall method by applying checks.	III	08
6	Prepare a contour plan of given area.	III	10
Total			56 Hrs.

Note

- 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.
- 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.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Identify different instruments in survey.	20
2	Operate all instruments used in survey.	20
3	Follow safe practices.	20
4	Record observations correctly.	20
5	Answer the question	10
6	Submission in time	10
Total		100

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 practical in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Vernier transit theodolite: Accuracy- 20sec, Magnification- 20X, Standard deviation 20" (direction deviation 5 mm at 100 m)	1 to 3
2	Tripod: Length - 16.5cm, Width – 25cm, Height – 114cm Material fiberglass and aluminum.	1 to 6
3	Ranging Rod: Material-Iron, Length- 2 or 3 m, Diameter- 3 cm, shod at bottom with heavy iron point, painted black and white or red and white in alternate band length of 20 cm.	1 to 6
4	Wooden pegs: Material-Timber, 2.5 to 3 cm ² and 15 cm long, Tape red at the end. Arrows: Material-Steel, Length- 25 cm to 50 cm, Diameter- 4 mm.	1 to 6
5	Dumpy level: Length- 175 mm, longest focusing distance- 200/300 m, Stadia constant- 1:100, Weight- 2.350 Kg.	4 to 6
6	Quick set level: It has ball and socket joint arrangement, Weight – 2 Kg, Range- 250 m.	4 to 6
7	Auto set level: Shortest focusing distance- 0.65 m, Objective Aperture- 40 mm, Standard deviation for 1 km double run leveling- 2.0 mm.	4 to 6
8	Solid staff: Length- 10 feet, smallest division- 5 mm. Folding staff: Length- 2 m, width- 75 mm, thickness- 18 mm. Telescopic staff: Vertical length- 4 m. (upper length- 1.2 m, middle length- 1.3 m, lower length- 1.5 m)	4 to 6

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 competency.

- Work as a leader/a team member.
- Follow safe practice on survey site.
- Realize importance of survey in mining.

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:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- '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: Theodolite - I	1a. Describe construction, temporary and permanent adjustments of theodolite. 1b. Define terms used and list parts of a theodolite. 1c. Describe steps to measure the Following listed using a theodolite for surveying horizontal angle, vertical angle, bearings, ranging, establishing new station.	1.1 Survey equipment-Theodolite: Parts, Terms used, Temporary and permanent adjustments. 1.2 Technical Terms: The vertical axis, the horizontal axis, the line of sight or line of collimation, the axis of level tube, Centering, Transiting, Swinging the telescope, Face left observation, Face right observation, Telescope normal, Telescope inverted, Changing face. 1.3 Measurements: such as ranging, establishing new station, horizontal angle, vertical angle, bearings.
Unit – II: Theodolite-II	2a. Enumerate the traverse by theodolite closed and open traverse carryout open and Closed traversing. 2b. Included and direct angles, Latitude, departures, 2c. Describe checks corrections of the traverse. 2d. State the Bowditch rule and transit rule	2.1 Introduction to traverse, closed and Open traverse 2.2 Included angles and direct angles, Latitude, departures. 2.3 Checks-corrections of the Traverse – Bowditch rule and transit rule.
Unit – III: Levelling	3a. Explain different methods and their procedure for levelling. 3b. Explain procedure for using the instruments and levelling staff and entering level in proper table. 3c. Carryout corrections for errors in levelling records if any. 3d. Prepare contour maps by calculating Reduce level as per data book.	3.1 Introduction and basic terminology related with levelling like Level surfaces, horizontal & vertical surfaces, datum, bench marks, reduced level, rise, fall, line of collimation, axis of telescope, axis of bubble tube, station, back sight, fore sight, intermediate sight, change point, height of instruments, focusing and parallax etc. 3.2 Types of level dumpy level, quick set level, auto level, digital level and components of dumpy level with neat sketch. 3.3 Types of levelling staffs self-reading staff & target staff. 3.4 Temporary adjustment of level.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
		3.5 Classification of Levelling – simple levelling, differential levelling, fly levelling, profile levelling, reciprocal levelling and precise levelling. 3.6 Examples & methods of finding out the R. L. in level book by H.I. method and rise & fall methods with necessary check. 3.7 Errors in levelling. 3.8 Contour and Uses of contours. 3.9 Characteristics of contours. 3.10 Methods of Contouring.
Unit – IV: Use of Level in Surface & Underground working	4a. Measure all the level differences from surface to underground working.	4.1 Depth of shaft and other working. 4.2 Underground bench mark- datum throw of fault - gradient of roadway and length of drift to cross the fault. 4.3 Subsidence - 4.3.1. Types of subsidence 4.3.2. Subsidence Survey i. Vertical movement ii. Horizontal movement
Unit – V: Dip Strike Problems	5a. Solve problems related to geological configuration/ disturbances of ground.	5.1 True and apparent dip and strike from borehole data. 5.2 Deviation in the borehole drilling 5.3 Bearings and dip of various mine working

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

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	Theodolite – I	12	05	04	05	14
II	Theodolite – II	10	05	04	05	14
III	Levelling	12	04	08	08	20
IV	Use of Level in Surface & Underground working	10	05	02	03	10
V	Dip Strike Problems	12	05	03	04	12
Total		56	24	21	25	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) Prepare specification table for different types survey instruments.
- b) List out the provisions for maintenance of survey instruments
- c) Give seminar on any surveying method.
- d) Visit of mine to use surveying equipment and prepare reports / maps
- e) 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/subtopics.
- 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 survey site.
- g) Use different instructional strategies in classroom teaching.

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 is 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:

- Perform land survey work with the help of theodolite and prepare a sheet with all necessary checks and correction.
- Carry out small projects for subsidence measurement and finding out the strike and gradient of seam.
- Field works for different survey work like subsidence measurement levelling traversing, depth measurement etc.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Mine Surveying and Levelling – Vol.1	S. Ghatak	Lovely Prakashan, Dhanbad (Bihar)
2	Mine Surveying and Levelling – Vol.2	S. Ghatak	Lovely Prakashan, Dhanbad (Bihar)
3	Surveying – Vol.1	Dr. B.C.Punmia Er. Ashok K. Jain Dr. Arun kumar Jain	Laxmi Publication, New Delhi ISBN: 9788170088530

14. SOFTWARE/LEARNING WEBSITES

- www.nptel.ac.in
- <https://ndl.iitkgp.ac.in>
- www.dgms.gov.in
- <https://surveyofindia.gov.in>
- <http://en.wikipedia.org/wiki/Surveying>
- <http://nptel.iitm.ac.in/courses/Webcourse-contents/IITROORKEE/SURVEYING/home.htm>
- <http://freevideolectures.com/Course/98/Surveying>
- www.gsi.com

15. PO-COMPETENCY-CO MAPPING

Semester III	Mine Surveying-I (Course Code: 4332203)								
	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	Survey and prepare drawings and interpret various mine plans and sections for mining operations.								
Course Outcomes									
CO1: Operate and adjust theodolite.	2	2	-	2	-	-	2	-	-
CO2: Apply all checks needed to adjust traverse survey.	2	2	-	1	-	-	2	-	-
CO3: Prepare contour map of various land by using level.	3	1	-	1	-	2	2	-	-
CO4: Demonstrate fault, subsidence and depth measurement survey.	2	2	-	-	-	2	2	-	-
CO5: Measure direction and inclination of underground roadways.	2	2	-	-	-	-	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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