Gyanmanjari Innovative University

Syllabus
Gyanmanjari Institute of Technology
Semester-1 (B. Tech.)

Subject: Professional Surveying and Civil Drafting Skills– BET2CV10301

Type of Course: Engineering Science Courses

Prerequisite: Basic knowledge of mathematics, geometry, measurements and elementary drawing concepts.

Rationale: This course introduces students to the fundamental principles and practices of surveying and civil drafting, which form the foundation for planning, design and execution in civil engineering. It develops competency in field measurements, data recording, mapping, and digital drafting using CAD tools. The subject prepares students for advanced courses in surveying, transportation, geotechnics, construction and design

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	2	5	100	50	150

Legends: CI-Classroom Instructions; T-Tutorial; P -Practical; C –Credit; SEE -Semester End Evaluation; CCE-Continuous and Comprehensive Evaluation

Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
1	**Introduction to Surveying and Basic Principles** ***Theory Topics:*** Introduction to Surveying, Definition and Objectives of Surveying, Principles of Surveying, Classification of Surveying, Scales Used in Surveying, Conventional Survey Symbols, Units and Measurements in Surveying, Accuracy and Precision in Surveying, Types of Errors and Corrections, Surveying Instruments and Their Uses, Field Books and Recording Methods, Importance of Surveying in Civil Engineering. ***Practical:*** 1. Identify and handle basic surveying instruments such as chains, tapes, ranging rods, compasses, and levels, and understand their	10	20 %

functions, operation, and maintenance.
2. Perform linear measurements using chains, tapes, and ranging rods to determine distances and alignments accurately in the field.
3. Use conventional surveying symbols and engineering scales to prepare simple survey drawings and graphical representations.
4. Record field observations systematically in a field book and understand the importance of accurate documentation in surveying work.
5. Observe and identify common measurement errors caused by instruments, methods, and human factors, and understand their effects on survey accuracy.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Surveying Principles and Measurement Analysis** Students will be assessed through analytical and problem-solving tasks based on the fundamental principles of surveying, scales, conventional symbols, units and measurements, surveying instruments, field book recording, and error analysis. The evaluation may include conceptual applications, instrument- based situations, measurement interpretation, and field recording problems to assess students' understanding of surveying techniques and measurement practices. The assessment will focus on conceptual clarity, analytical thinking, accuracy in calculations and observations, and structured presentation of solutions.	20	
2	**Active Learning Activity:** **Observation and Recording Activity** Students will work in groups to perform practical activities involving the identification and handling of surveying instruments, scale drawing exercises, field observation recording, and measurement error identification. They will demonstrate the use of chains, tapes, ranging rods, compass, and leveling instruments, along with the preparation of field book entries and graphical representation using conventional symbols and engineering scales. The activities will emphasize		10

		precision in measurement, proper recording methods, observation skills, and awareness of common surveying errors. This activity will enhance students' practical understanding of basic surveying techniques and field procedures. The final work shall be prepared and submitted in the form of a Poster Presentation through the GMIU Web Portal.			
		Total	**20**	**10**	

Examination Style:

Surveying Principles and Measurement Analysis Task (20 Marks)

Students will be assessed through four analytical and problem-based questions covering the fundamental concepts of surveying. The questions may include scales, conventional symbols, surveying instruments, field book recording methods, measurement interpretation, and error analysis. Students will be required to apply surveying principles to practical situations, analyse given data, and present logical solutions. The assessment will focus on conceptual understanding, analytical skills, accuracy of interpretation, and clarity of presentation.

Observation and Recording Activity (10 Marks)

Students will perform practical activities involving the identification and handling of surveying instruments such as chains, tapes, ranging rods, compass, and level. The activity will include basic linear measurements, alignment exercises, preparation of drawings using engineering scales and conventional symbols, recording field observations in survey field books, and identification of common measurement errors caused by instruments, methods, or human factors. Students will demonstrate proper surveying practices, measurement techniques, and recording methods while maintaining accuracy and neatness. Evaluation shall be based on practical performance, measurement accuracy, quality of field records and drawings, understanding of surveying concepts, analytical ability to identify errors, participation, and report submission.

2	**Chain Surveying** ***Theory Topics:*** Introduction to Chain Surveying, Principles of Chain Surveying, Chains, Tapes and Surveying Accessories, Ranging Methods in Surveying, Chaining Methods and Procedures, Offsets and Tie Lines, Obstacles in Chaining and Their Solutions, Field Book Recording and Booking, Plotting of Chain Survey, Applications and Limitations of Chain Surveying.	25	20 %

Practical:

6. Perform direct and indirect ranging and measure distances using chains and tapes to develop skills in alignment and accurate field measurement.
7. Measure perpendicular and oblique offsets along with tie lines to locate and record details within a survey area accurately.
8. Conduct a chain survey of a small plot using appropriate survey stations and lines, and collect field data systematically.
9. Record survey observations in a standard field book using proper conventions, symbols, and notations for accurate documentation.
10. Plot a chain survey plan from recorded field data using a suitable scale and standard plotting techniques.
11. Practice chaining and ranging across obstacles using appropriate field methods and techniques to overcome practical difficulties.
12. Identify common errors in chain surveying and apply suitable correction methods to improve the accuracy and reliability of measurements.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Chain Survey Analysis** Students will be assessed through analytical and problem-solving tasks based on principles of chain surveying, ranging, chaining methods, offsets, tie lines, obstacles in chaining, field booking, and plotting of survey data. The evaluation may include practical survey situations, measurement-based problems, and plotting applications to assess students' understanding of field survey procedures and graphical representation techniques. The assessment will focus on conceptual understanding, analytical ability, accuracy in measurements and plotting, and structured presentation of solutions.	20	
2	**Active Learning Activity:** **Field Measurement and Survey Recording Activity** Students will perform practical activities involving ranging and chaining exercises, offset and tie line measurements, field booking, obstacle handling, and plotting of chain survey data. Students will conduct chain surveys of simple plots, record		10

		observations in standard field book format, and prepare survey plans using suitable scales and plotting methods. The activities will emphasize precision in measurement, systematic recording, graphical representation skills, and awareness of errors and correction methods in chain surveying practice. Students will submit observations, field records, and plotted drawings in a structured format on the GMIU Portal.				
		Total	**20**	**10**		

Examination Style:

Chain Survey Analysis and Plotting Task (20 Marks)

Students will be assessed through four analytical and problem-based questions covering the fundamental principles of chain surveying. The questions may include ranging, chaining methods, offsets, tie lines, obstacles in chaining, field booking, and plotting of chain survey data. Students will be required to analyse practical surveying situations, perform necessary calculations, interpret field observations, and apply appropriate surveying methods. The assessment will focus on conceptual understanding, accuracy in calculations and plotting, problem-solving ability, interpretation of field data, and clarity of presentation.

Field Measurement and Survey Recording Activity (10 Marks)

Students will perform practical field activities involving direct and indirect ranging, chaining, offset measurements, and tie line observations using chains, tapes, and ranging rods. They will record survey observations in a standard field book format and prepare plotted plans from field measurements using appropriate scales and plotting techniques. The activity will also include identification and correction of common errors encountered during chain surveying. Students will demonstrate proper surveying methods, accurate measurement techniques, and systematic recording practices. Evaluation shall be based on practical performance, measurement accuracy, quality of field records and plotted drawings, analytical understanding of errors, participation, and report submission.

3	**Compass Surveying and Levelling** ***Theory Topics:*** Compass Surveying, Bearings and Meridians, Prismatic Compass and Its Components, Traverse Surveying, Local Attraction and Its Correction, Introduction to Levelling, Principles of Levelling, Types of Levelling Instruments, Levelling Staff and Staff Reading, Differential Levelling, Reduced Level (RL) Computations, Rise and Fall Method, Height of Collimation Method, Applications of Compass Surveying and Levelling in Civil Engineering.	25	20 %

Practical:

13. Measure whole circle bearings and reduced bearings of survey lines using a prismatic compass and record observations accurately.
14. Conduct a compass traverse of a small closed area and record bearings and angles to prepare traverse data.
15. Detect the effects of local attraction on compass observations and apply suitable corrections to obtain accurate bearings.
16. Study levelling instruments and perform their temporary adjustments to ensure proper setup and accurate observations.
17. Carry out differential levelling to determine reduced levels of selected points using staff readings and standard levelling procedures.
18. Calculate reduced levels from field observations using the Rise and Fall Method and perform necessary accuracy checks.
19. Determine reduced levels using the Height of Collimation Method and compare the results with other levelling computations.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Compass Survey Analysis and Traverse Plotting Task** Students will be assessed through analytical and problem-solving tasks based on principles of compass surveying, bearings and meridians, prismatic compass operation, traverse surveying, local attraction and its correction, field booking, and plotting of traverse survey data. The evaluation may include practical survey situations, bearing measurement problems, traverse computations, local attraction correction exercises, and plotting applications to assess students' understanding of compass survey procedures and graphical representation techniques. The assessment will focus on conceptual understanding, analytical ability, accuracy in bearing measurements and plotting, computational skills, and structured presentation of solutions.	20	
2	**Active Learning Activity: Compass Surveying and Levelling Field Exercise** Students will perform practical activities involving measurement of bearings using a prismatic compass, traverse surveying, identification and correction of local attraction, levelling operations using		10

		appropriate levelling instruments, staff reading, differential levelling, and RL calculations by Rise and Fall and Height of Collimation methods. Students will conduct field surveys of selected areas, record observations in standard field books and level books, prepare traverse sketches, compute bearings and reduced levels, and present survey results in a structured format. The activities will emphasize accuracy in observations, systematic field recording, computational skills, interpretation of survey data, and awareness of common errors and correction techniques. Students will submit field observations, calculation sheets, traverse sketches, and levelling records in a structured format on the GMIU Portal.				
		Total	**20**	**10**		

Examination Style:

Chain Survey Analysis and Plotting Task (20 Marks)

Students will be given four analytical and problem-based questions, each carrying 05 marks, covering the fundamental principles of chain surveying. The questions may involve ranging, chaining methods, offsets, tie lines, obstacles in chaining, field booking, and plotting of chain survey data. Students will be required to analyse practical surveying situations, perform calculations, interpret field observations, and apply appropriate surveying techniques to solve the given problems. The assessment will focus on conceptual understanding, accuracy in calculations and plotting, analytical and problem-solving skills, interpretation of field data, and clarity of presentation.

Compass Surveying and Levelling Field Analysis Activity, and Traverse and RL Computation Assignment (10 Marks)

Students will perform field-based, demonstration, and application-oriented activities related to compass surveying, bearings and meridians, prismatic compass operations, traverse surveying, local attraction correction, levelling procedures, staff readings, and Reduced Level (RL) computations. The activity will involve measuring bearings, conducting traverse surveys, recording field observations, performing RL calculations using Rise and Fall and Height of Collimation methods, and analysing survey data for practical engineering applications. Students will interpret survey results, identify possible errors, and study the application of compass surveying and levelling in civil engineering projects such as road alignment, site development, and construction layout.

<table>
<tr>
<td>4</td>
<td>
Plane Table Surveying and Contouring Theory

<u>Theory Topics:</u>

Introduction to Plane Table Surveying, Plane Table Instruments and Accessories, Radiation Method in Plane Table Surveying, Intersection Method in Plane Table Surveying, Traversing by Plane Table, Advantages and Limitations of Plane Table Surveying, Introduction to Contouring, Characteristics of Contours, Methods of Contour Mapping, Applications and Uses of Contours in Civil Engineering.

<u>Practical:</u>

20. Identify components of plane table surveying equipment and perform proper setup and orientation for fieldwork.
21. Conduct plane table surveying using the radiation method from a single station and plot surrounding points accurately.
22. Locate points using the intersection method and prepare a corresponding survey plot with correct graphical representation.
23. Perform plane table traversing for a simple area and prepare a field plot using systematic observations and station setup.
24. Collect spot levels and prepare a contour map to represent the topography of a given area.
25. Apply interpolation techniques to draw contour lines from observed level data at suitable intervals.
26. Interpret contour maps to identify slopes, ridges, valleys, and other terrain features for engineering applications.

Examination Style:
<table>
<tr><th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>Plane Table and Contour Mapping
Students will be assessed through analytical and problem-solving tasks based on plane table surveying methods, including radiation, intersection, traversing, contouring, and contour map interpretation. The evaluation may include practical survey situations, plotting problems, contour interpolation, and terrain analysis applications to assess students' understanding of field surveying and topographic representation techniques. The assessment will focus on conceptual understanding, analytical ability, accuracy in plotting and interpretation, and PPT presentation of solutions.</td><td>20</td><td></td></tr>
<tr><td>2</td><td>Plane Table Observation and Contour</td><td></td><td>10</td></tr>
</table>
</td>
<td>20</td>
<td>20%</td>
</tr>
</table>

		Mapping Activity Students will perform practical activities involving setup and orientation of plane table instruments, surveying by radiation and intersection methods, plane table traversing, contour mapping, and contour interpolation. Students will prepare survey plots and contour maps from field observations and analyze terrain features such as slopes, ridges, and valleys. The activities will emphasize field observation skills, graphical representation, contour interpretation, precision in plotting, and application-oriented learning.			
		Total	**20**	**10**	
		Plane Table and Contour Mapping Analysis Task (20 Marks) Students will be assessed through four analytical and problem-based questions covering plane table surveying methods and contouring principles. The questions may include radiation, intersection, traversing by plane table, contouring, contour interpolation, and interpretation of contour maps. Students will be required to analyse practical surveying situations, solve plotting-based problems, and interpret terrain characteristics using contour information. The assessment will focus on conceptual understanding, accuracy in graphical representation, analytical and mapping skills, interpretation of contour data, and clarity of presentation. **Plane Table Observation and Contour Mapping Activity (10 Marks)** Students will perform practical activities involving the setup, orientation, and use of plane table instruments, and conduct surveys using radiation, intersection, and traversing methods. They will prepare field plots based on observed data using proper surveying procedures and graphical techniques. In addition, students will prepare contour maps using given or collected level data through interpolation methods and analyze the terrain features represented in the contours. Students will identify and interpret slopes, ridges, valleys, and drainage patterns from the contour maps. Evaluation shall be based on practical performance, plotting and contour accuracy, observation skills, participation, analytical understanding of terrain, graphical presentation, and report submission.			
5		**Surveying Civil Drafting Records** ***Theory Topics:*** Introduction to Civil Drafting, Drawing Standards and Conventions in Civil Engineering, Survey Plan Preparation, Plotting Techniques in CAD, Traverse Plotting in CAD, Contour Drafting in CAD, Use of CAD in Surveying Applications, Preparation of Survey Records,		10	20 %

Survey Documentation and Reporting Methods, Importance of Accurate Survey Drafting and Records.

Practical:

27. Use basic CAD tools and commands to create simple survey drawings and develop familiarity with digital drafting standards and accuracy.
28. Prepare a chain survey plan in CAD using field measurements, appropriate scale, and standard drawing conventions.
29. Plot traverse survey data using CAD software and prepare accurate graphical representations of survey information.
30. Draft contour maps in CAD from level data to represent terrain features using digital topographic techniques.
31. Prepare survey field records, observation sheets, and documentation in proper engineering formats for systematic reporting.
32. Apply standard survey symbols, layers, dimensions, and annotations in CAD to produce clear and professional drawings.
33. Complete a mini survey project by integrating field data collection, CAD drafting, and documentation into a final presentation.

Evaluation Method:

Sr. No.	Evaluation Methods	SEE	CCE
1	**Survey Drafting and CAD Application** Students will be assessed through analytical and problem-solving tasks based on civil drafting principles, survey plan preparation, CAD-based plotting, traverse plotting, contour drafting, and survey record documentation. The evaluation may include drafting-based applications, drawing interpretation, coordinate plotting, and technical documentation problems designed to assess students' understanding of digital surveying practices and engineering drafting standards. The assessment will focus on conceptual understanding, drafting accuracy, analytical ability, and structured presentation of solutions and drawings.	20	
2	**CAD Drafting and Documentation Activity** Students will perform activities related to flow measurement devices such as notches, weirs, orifices, and discharge		10

		measurement systems to understand practical flow analysis and measurement techniques. Students will also carry out case study–based or innovation-oriented activities involving boundary layer behavior, drag effects, aerodynamic applications, or external flow phenomena. These activities will help students understand the practical application of flow measurement and external flow principles in engineering systems.				
		Total	**20**	**10**		

Examination Style:

Survey Drafting and CAD Application Task (20 Marks)
In this task, students will be given four analytical/problem-based questions, each carrying 05 marks, based on civil drafting principles, survey plan preparation, CAD-based plotting, traverse plotting, contour drafting, and survey record documentation. The questions may include drafting applications, drawing interpretation, contour representation, coordinate plotting, and technical record preparation problems designed by the faculty to assess students' analytical understanding, drafting proficiency, and problem-solving abilities. The assessment shall emphasize conceptual clarity, drafting precision, application of engineering drawing standards, and structured presentation of answers.

CAD Drafting and Documentation Activity (10 Marks)
Students will perform practical CAD drafting activities involving preparation of chain survey layouts, traverse plots, and contour maps using field data and standard engineering conventions. They will apply appropriate symbols, dimensions, annotations, and layer management techniques to produce accurate digital drawings. In addition, students will prepare complete survey documentation, including field records, observation sheets, technical reports, and integrated survey drawings in proper engineering format. The activity may also include compiling a mini survey project by combining field data, CAD outputs, and documentation. Evaluation shall be based on drafting accuracy, use of CAD tools, graphical presentation skills, systematic documentation, organization of technical data, digital competency, and report submission.

Suggested Specification table with Marks (Theory): 100

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	15%	30%	15%	10%	20%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Explain the fundamental principles, methods, instruments and terminology used in surveying and civil drafting.
CO2	Perform basic field measurements and apply conventional surveying techniques.
CO3	Prepare, interpret and maintain survey observations, field records, contour maps and engineering drawings using standard practices.
CO4	Develop and draft survey plans using CAD tools by applying appropriate drawing standards, symbols and documentation methods.
CO5	Analyze simple surveying problems, identify errors and apply surveying and drafting knowledge to basic civil engineering applications.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students.

A minimum of 20–30% of the course content shall be suggested to deliver through Flipped Learning, where students study digital learning resources before the classroom session. Classroom time shall be utilized for discussion, problem-solving, practical applications, and higher-order learning activities.

Students shall be encouraged to use AI-powered learning platforms, simulation software, virtual laboratories, digital libraries, research databases, online certification courses, NPTEL, SWAYAM, MOOCs, and other technology-enabled learning resources to strengthen conceptual understanding and practical competence.

Continuous assessment shall be conducted through Active Learning Assignments (ALAs), quizzes, skill demonstrations, presentations, practical exercises, projects, case studies, innovation activities, peer assessment, reflective learning, and industry-oriented tasks instead of relying primarily on conventional written assignments.

Reference Books:

[1] Surveying Vol. I, Dr. B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, ISBN: 978-8131808148.
[2] Surveying and Levelling (Vol. I), T.P. Kanetkar & S.V. Kulkarni, Pune Vidyarthi Griha Prakashan, ISBN: 978-8185825825.
[3] Fundamentals of Surveying, S.K. Roy, PHI Learning, ISBN: 978-8120341953.
[4] A Textbook of Surveying, C. Venkatramaiah, Universities Press, ISBN: 978-8173715794.
[5] Surveying Theory and Practice, James M. Anderson & Edward M. Mikhail, McGraw Hill Education, ISBN: 978-0070159145.
[6] Elementary Surveying: An Introduction to Geomatics, Elementary Surveying (Charles D. Ghilani & Paul R. Wolf), Pearson, ISBN: 978-0134604659.
[7] Engineering Drawing with AutoCAD, Kulkarni D.M., PHI Learning, ISBN: 978-8120347757.