



UNIVERSITAS PENDIDIKAN INDONESIA

SEMESTER LEARNING PLAN (RPS)

COURSE INFORMATION

Course Name	Course Code	Credits	Workload	Course Group	Semester	Prerequisite Course	Date of Issue
ENGINEERING SURVEY	SA503	2	90	Study Program Expertise Course		Mathematics and Physics; Cartography, Terrestrial Mapping	2025-09-09 11:26:56

Prepared by	Reviewed by	Approved by
Nanin Trianawati Sugito, M.T.	Shafira Himayah, S.Pd., M.Sc.	Dr. Lili Somantri, S.Pd., S.S., M.Si.

COURSE DESCRIPTION AND LERANING OUTCOMES

Course Description	The Engineering Survey course covers the knowledge and skills that must be possessed in carrying out advanced operations of the stages of management and planning of survey and mapping activities in the field of engineering surveys. It plays a role in decision making based on the analysis of information and data obtained from measurements. Students are able to apply the field of surveying and mapping and are able to solve problems and adapt to the situations encountered. The concepts studied include the basic concepts of sine, cosine, and tangent in determining angles and distances; planning engineering measurement activities; reading Detail Engineering Design; performing stake out points in the field using the Global Navigation Satellite System (GNSS) with realtime correction; understanding terrestrial laser scanning; calculating surface area and volume from measurement results; preparing measurement reports; conducting quality control; performing coordinate system transformations; and carrying out occupational health and safety communication.	
Program Learning Outcome Assigned in the Course	1	S-9 Demonstrate a responsible attitude toward work in their field of expertise independently
	2	P-1 Master the theoretical concepts of surveying and mapping of resources (natural, social, and cultural) and possess the skills to apply various methods of surveying and mapping of resources (natural, social, and cultural)
	3	P-2 Master the theoretical concepts of large-scale surveying and mapping with high accuracy and possess the skills to use instruments and equipment for large-scale mapping
	4	KU-2 Able to demonstrate quality and measurable performance
	5	KU-3 Able to solve work problems with characteristics and contexts appropriate to their applied field of expertise, based on logical, innovative thinking, and responsible for the results independently
	6	KU-5 Able to cooperate, communicate, and innovate in their work
	7	KU-6 Able to take responsibility for the achievement of group work results and conduct supervision and evaluation of the completion of tasks assigned to workers under their responsibility
	8	KK-1 Able to operate surveying and mapping equipment
	9	KK-2 Able to conduct surveys in the field of resources (natural, social, and cultural) within a region
	10	KK-6 Able to report survey results, mapping, and geographic information in the field of resources (natural, social, and cultural)
	11	KK-7 Able to follow the development of science and technology related to surveying, mapping, and geographic information
Course Learning Outcome (CPMK)	1	Students are able to accurately explain the principles, basic concepts of science, art, and technology of engineering survey for mapping and engineering needs
	2	Students are able to implement staking out methods to reconstruct coordinates in the field
	3	Students are able to collaborate in planning engineering survey activities
	4	Students are able to perform acquisition related to the measurement process in engineering surveys
	5	Students are able to perform data processing from measurement results in engineering surveys

	6	Students are able to prepare engineering survey reports and pay attention to their quality control	
Sub-CPMK	1	CPMK - 1	Students are able to understand and follow lecture regulations, course syllabus, study learning plan of the course, and are able to explain the basic concepts of science, art, and technology of engineering surveys
	2	CPMK - 1	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys
	3	CPMK - 2	Students are able to plan engineering measurement activities and read detail engineering design from basic data
	4	CPMK - 2	Perform stake out points in the field using various methods
	5	CPMK - 3	Students are able to manage teamwork related to the knowledge, skills, and work attitudes required in managing work teams, organizing task delegation, conducting team coordination, and controlling work
	6	CPMK - 4	Students are able to understand the concept of staking one point and two points and students are able to understand horizontal curve surveys and implement horizontal curve staking in the field according to the planned design
	7	CPMK - 4	Students are able to apply transition curves, superelevation, vertical curves and their calculations and students are able to understand volume calculation and its application in the field
	8	CPMK - 5	Students are able to process data from measurements of horizontal curves, vertical curves, area calculation, and volume according to the principles of engineering surveys
	9	CPMK - 6	Students are able to write reports on acquisition results, processing results, and evaluation results of engineering survey measurements along with analysis and the quality control process
Course Materials	1	Basic mathematics of geometry and trigonometry	
	2	Application of highway geometry measurement	
	3	Application of horizontal alignment and vertical alignment measurement	
	4	Application of measurement of building height, area, and volume	
	5	Staking out horizontal alignment and vertical alignment, buildings, and plots	
	6	Measurement and calculation of excavation and embankment volume	

Learning outcomes demonstrated at the end of the course *)	At the end of the Engineering Surveying course, students should be able to demonstrate the following learning outcomes, supported by evidence: 1. Proficiency in Surveying Techniques Evidence: Successful completion of practical field exercises, showing accurate measurement of distances, angles, and elevations. Students can present detailed field notes and logs as proof of their competency. 2. Competence in Using Surveying Instruments Evidence: Demonstrated ability to correctly set up, calibrate, and use surveying instruments (e.g., theodolites, total stations, GPS) during hands-on assessments. Performance in practical exams and project work will serve as evidence. 3. Data Collection, Analysis, and Interpretation Evidence: Accurate and well-organized survey data presented in reports, showcasing the ability to collect, analyze, and interpret measurements. Students can provide plotted maps and profiles as evidence of their data handling skills. 4. Application of Mapping and Software Tools Evidence: Creation of detailed maps, plans, and layouts using software like AutoCAD or GIS. The quality and accuracy of digital submissions can serve as evidence of proficiency in these tools. 5. Project Planning and Execution Evidence: Completion of a comprehensive survey project from planning to execution, including a final report that outlines the objectives, methodology, results, and conclusions. Group or individual project presentations will provide additional proof. 6. Understanding of Ethical, Legal, and Safety Considerations Evidence: Case study analyses, essays, or presentations that demonstrate awareness of ethical, legal, and safety issues in surveying. Students may provide examples of how they applied this knowledge during fieldwork. 7. Ability to Work Collaboratively and Professionally Evidence: Positive peer evaluations, participation in group projects, and feedback from instructors on teamwork and communication skills. Documented evidence of professional behavior during field exercises and class activities. These learning outcomes, supported by the corresponding evidence, ensure that students are well-prepared for professional roles in engineering surveying.	
Learning Strategy	✓	Case Method
		Team based Project
		Lainnya
Learning Stages	1. Introduction to Surveying Principles Objective: Understand the basic principles of surveying. Content: Definition and importance of surveying in engineering. History and development of surveying. Overview of different types of surveys (e.g., land, construction, hydrographic). Activities: Classroom lectures and discussions. Introduction to surveying equipment and tools. 2. Understanding Surveying Instruments Objective: Learn about various surveying instruments and their uses. Content: Introduction to instruments like theodolite, total station, leveling instruments, GPS, etc. Calibration and maintenance of surveying instruments. Activities: Hands-on practice with instruments. Demonstrations on how to set up and use different tools. 3. Measurement Techniques Objective: Master the fundamental measurement techniques used in surveying. Content: Distance measurement (e.g., taping, electronic distance measurement). Angle measurement (horizontal and vertical angles). Elevation measurement (differential leveling). Activities: Field exercises to practice measurements. Calculation exercises to analyze the data obtained. 4. Data Collection and Recording Objective: Learn how to collect, record, and manage survey data accurately. Content: Data collection methods (manual and electronic). Field notes and survey logs. Error analysis and adjustments in measurements. Activities: Fieldwork to gather data. Classroom sessions on data recording techniques. 5. Mapping and Plotting Objective: Understand how to create maps and plans based on survey data. Content: Introduction to mapping techniques and software (e.g., AutoCAD, GIS). Plotting contours, profiles, and cross-sections. Preparing site plans and layouts. Activities: Map creation exercises. Use of computer software for plotting survey data. 6. Advanced Surveying Techniques Objective: Explore more advanced techniques used in complex surveys. Content: GPS and GIS integration in surveying. Aerial and satellite surveying. Hydrographic and underground surveying. Activities: Specialized field projects. Case studies on advanced survey projects. 7. Project Planning and Execution Objective: Learn how to plan and execute a surveying project from start to finish. Content: Project management principles in surveying. Developing a survey plan (scope, objectives, resources). Executing the survey and post-survey analysis. Activities: Group projects involving real-world scenarios. Presentations on survey findings and recommendations. 8. Ethics, Safety, and Professionalism in Surveying Objective: Understand the ethical, legal, and safety considerations in surveying. Content: Ethical responsibilities of a surveyor. Safety protocols in the field. Legal aspects, including boundary disputes and land rights. Activities: Case studies on ethical issues in surveying. Discussions on safety practices and regulations. 9. Assessment and Evaluation Objective: Evaluate your knowledge and skills in surveying. Content: Quizzes, mid-term exams, and final exams. Practical assessments in fieldwork. Peer reviews and self-assessment of projects. Activities: Written and practical exams. Submission of final survey projects and reports. 10. Continuous Learning and Professional Development Objective: Encourage lifelong learning and staying updated with the latest trends in surveying. Content: Importance of certification and licensure (e.g., Professional Surveyor License). Attending workshops, seminars, and conferences. Keeping up with technological advancements in surveying. Activities: Networking with professionals. Participating in professional development courses.	

References	1	1. "Surveying: Theory and Practice" by James M. Anderson and Edward M. Mikhail A comprehensive guide covering the theory and practice of surveying, including both basic concepts and advanced techniques. It's known for its depth and clarity.
	2	2. "Elementary Surveying: An Introduction to Geomatics" by Charles D. Ghilani and Paul R. Wolf This is a widely used textbook for introductory surveying courses. It covers topics like distance measurement, leveling, angles, directions, and GPS systems.
	3	3. "Surveying with Construction Applications" by Barry F. Kavanagh and Diane K. Slattery This book integrates surveying with real-world construction applications, making it ideal for students interested in the practical aspects of engineering surveying.
	4	4. "Engineering Surveying" by W. Schofield and Mark Breach This text covers the essential aspects of engineering surveying, including traditional methods and modern techniques like GPS and GIS.
	5	5. "GPS for Land Surveyors" by Jan Van Sickle A focused guide on GPS technology, a key tool in modern surveying. This book is particularly useful for students wanting to deepen their understanding of GPS applications in surveying.
	6	6. "Geodesy: The Concepts" by Petr Vaní?ek and Edward Krakiwsky For those interested in the theoretical aspects of surveying, particularly geodesy, this book offers a strong foundation in the concepts of earth measurements.
	7	7. "Adjustment Computations: Spatial Data Analysis" by Charles D. Ghilani This book is excellent for understanding the statistical adjustments in surveying, including least squares adjustments, error analysis, and other advanced topics.

LEARNING PLAN

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Method (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
1	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys..	Students are able to understand the applicable lecture regulations, the course syllabus, and are able to plan their studies according to the semester learning plan design and are also able to understand the basic concepts, science, art, and technology of Engineering Survey in life and in the scientific field of Geographic Information Science.	Basic mathematics of geometry and trigonometry	Participatory	5	Face-to-face	Reading assignment	100	2,7	04-09-2024 13:00
2	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys.	Students are able to explain the basic concepts, science, art, and technology, methods, equipment, scope limitations of engineering survey science, and the basic data required in the engineering survey process.	Application of highway geometry measurement	Observation	5	Face-to-face	Independent assignment	100	1,2,4,7	09-09-2024 13:00
3	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys.	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys including basic data, road alignment design, types of horizontal alignment, components, and engineering objectives.	Application of horizontal alignment and vertical alignment measurement	Observation	5	Face-to-face	Independent assignment	200	1,2	17-09-2024 07:00

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Method (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
4	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys.	Students are able to accurately explain the basic concepts, methods, equipment, limitations, and basic data related to the basic concepts of science, art, and technology in engineering surveys, including horizontal curve measurement methods and how each method has its advantages and disadvantages, as well as how decision making is determined based on field analysis for selecting the appropriate horizontal curve measurement method.	Application of horizontal alignment and vertical alignment measurement	Observation	5	Face-to-face	Reading assignment	200	2,3,7	24-09-2024 07:00
5	Students are able to plan engineering measurement activities and read detail engineering design from basic data.	Students are able to understand and perform calculations for simple horizontal curve planning, understand the required basic data, and plan measurement techniques including distance and angle measurements. Measurement techniques objective: Master the fundamental measurement techniques used in surveying. Content: Distance measurement (e.g., taping, electronic distance measurement). Angle measurement (horizontal and vertical angles). Elevation measurement (differential leveling). Activities: Field exercises to practice measurements. Calculation exercises to analyze the data obtained.	Application of horizontal alignment and vertical alignment measurement	Performance	5	Face-to-face	Independent assignment	200	1,2,4,6	01-10-2024 07:00

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Method (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
6	Students are able to plan engineering measurement activities and read detailed engineering design from basic data.	Students are able to plan engineering measurement activities through the planning of longitudinal sections, cross sections, elevation point measurements for contour mapping, and detail situation measurements to prepare engineering survey measurements of roads in the form of horizontal alignment and vertical alignment.	Application of Horizontal Alignment and Vertical Alignment Measurement.	Participatory	5	Face-to-face	Practicum assignment	120	2,7	08-10-2024 07:00
7	Conducting stake out of points in the field using various methods.	Students are able to perform initial measurements before conducting stake out of points in the field using various methods. The measurements carried out include horizontal control network measurement, vertical control network measurement, detail situation measurement, elevation point measurement for contour maps, longitudinal section measurement, cross section measurement, and sketch preparation using basic data from satellite imagery or aerial photographs.	Application of Horizontal Alignment and Vertical Alignment Measurement.	Performance	15	Face-to-face	Practicum assignment	200	1,3,7	15-10-2024 07:00
8	Conducting stake out of points in the field using various methods.	Students are able to plan staking out measurements in the field and previously conduct measurements of the basic data required before the implementation of staking out, including horizontal control network (KDH) measurement, vertical control network (KDV) measurement, benchmark (BM) measurement, contour map creation, elevation point measurement, detail situation measurement, and existing road measurement in long and cross sections.	Staking Out of Horizontal Alignment and Vertical Alignment, Buildings, and Parcels.	Essay	20	Face-to-face	-	100	1,2,3,4	29-10-2024 07:00

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Method (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
9	Students are able to manage a work team related to the knowledge, skills, and work attitudes required in managing a work team, organize task delegation, conduct team coordination, and control the work.	Students are able to plan stake out activities for horizontal curves.	Application of horizontal alignment and vertical alignment measurement	Performance	5	Face-to-face	Practicum assignment	340	2	05-11-2024 07:00
10	Perform stake out points in the field using various methods	Students are able to perform staking out of points in the field after carrying out planning and implementation of measurements. basic measurements before staking the horizontal alignment	Staking out horizontal alignment and vertical alignment, buildings, and plots	Participatory	5	Face-to-Face – Practicum	Practicum assignment	340	1,2,3,6,7	12-11-2024 07:00
11	Perform stake out points in the field using various methods.	Students are able to conduct a preliminary survey (field orientation), carry out planning based on the results of the orientation, and solve problems as well as determine appropriate decisions based on terrain analysis results, and subsequently be able to perform basic mapping (cross section and long section) for the preparation of staking out horizontal and vertical curves.	Staking out horizontal alignment and vertical alignment, buildings, and plots	Participatory	5	Face-to-face	Practicum assignment	100	1,3	19-11-2024 07:00

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Method (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
12	Students are able to manage a work team related to the knowledge, skills, and work attitudes required in managing a work team, organize task delegation, conduct team coordination, and control the work.	Students are able to conduct a preliminary survey (field orientation), carry out planning based on the results of the orientation, solve problems, and determine appropriate decisions based on terrain analysis results, and subsequently be able to perform basic mapping (cross section and long section) for the preparation of staking out horizontal and vertical curves.	Staking out horizontal alignment and vertical alignment, buildings, and plots	Participatory	5	Face-to-face	Practicum assignment	100	7	26-11-2024 07:00
13	Students are able to understand the concept of staking one point and two points and are able to understand horizontal curve surveys as well as implement horizontal curve staking in the field according to the planned design.	Students are able to carry out horizontal curve staking after obtaining the basic data derived from previous surveys including KDH, KDV, situation details, and contour mapping of the area where staking out will be conducted.	Staking out horizontal alignment and vertical alignment, buildings, and plots	Participatory	5	Face-to-face	Practicum assignment	340	1,3,6,7	03-12-2024 07:00
14	Students are able to apply transition curves, superelevation, vertical curves and their calculations and are able to understand volume calculation and its application in the field.	Students are able to apply horizontal and vertical curve planning through staking out measurements in the field based on the available basic data.	Staking out horizontal alignment and vertical alignment, buildings, and plots	Participatory	5	Face-to-face	Practicum assignment	340	2,7	10-12-2024 07:00

Week -	Sub-CPMK	Learning Indicator	Course Material	Assessment		Learning Method		Duration (hours)	Reference	Access Time
				Assessment Methode (test/non-test)	Assessment Weighting (%)	Synchronous	Asynchronous			
15	Students are able to process measurement data from horizontal curves, vertical curves, area calculations, and volume according to the principles of engineering surveys.	Students are able to process measurement data according to procedures.	Staking out horizontal alignment and vertical alignment, buildings, and plots	Participatory	2	Face-to-face	Practicum assignment	100	2,7	17-12-2024 07:00
16	Final examination (UAS)				3					18-12-2024 07:00

STUDENT LEARNING TIME (WORKLOAD)

LEARNING	ACTIVITIES		SYNCHRONOUS (Face-to-Face / Virtual Meeting)	ASYNCHRONOUS (Structured / Independent)	STUDENT LEARNING PREPARATION	TOTAL STUDENT LEARNING AND INSTRUCTION TIME
	Lectures/Responses/Tutorials		14 x 90 minute = 1260 minute	-x-	14 x 10 minute = 140 minute	1400 minute (23.3 hour)
	Project-based learning		8 x 120 minute = 960 minute	-x-	6 x 30 minute = 180 minute	1140 minute (19.0 hour)
	Discussion (case-based learning)		4 x 60 minute = 240 minute	-x-	-x-	240 minute (4.0 hour)
	TOTAL					2780 minute (46.3 hour)
ASSESSMENT		Continuous Assessment				
		Participation During Learning	14 x 60 minute = 840 minute	-x-	-x-	840 minute (14.0 hour)
		Project Completion	4 x 165 minute = 660 minute	-x-	-x-	660 minute (11.0 hour)
		Assignments	4 x 240 minute = 960 minute	-x-	-x-	960 minute (16.0 hour)
		Quizzes	4 x 10 minute = 40 minute	-x-	-x-	40 minute (0.7 hour)
		Formative				60 minute (1.0 hour)
		Summative				60 minute (1.0 hour)
	TOTAL					2620 minute (43.7 hour)
TOTAL WORKLOAD						5400 minute (90 hour)
TOTAL IDEAL HOURS						90 hour
CREDITS						2
CONFORMITY WITH THE NUMBER OF CREDITS						APPROPRIATE

CPMK ASSESSMENT CRITERIA

No	CPMK	CPL											TAXONOMY	Weight	CPMK ACHIEVEMENT CRITERIA
		CPL-1	CPL-2	CPL-3	CPL-4	CPL-5	CPL-6	CPL-7	CPL-8	CPL-9	CPL-10	CPL-11			
1	Students are able to accurately explain the principles and the basic concepts of science, art, and technology of engineering survey for mapping and engineering purposes.												1	20	90% of all students obtain a score of at least 80 (scale 100) .
2	Students are able to implement staking out methods to reconstruct coordinates in the field.												3	55	70% of all students obtain a score of at least 70 (scale 100) .
3	Students are able to collaborate in planning engineering survey activities.												3	10	70% of all students obtain a score of at least 70 (scale 100) .
4	Students are able to perform acquisition related to the measurement process in engineering surveys.												6	10	60% of all students obtain a score of at least 70 (scale 100) .
5	Students are able to process data obtained from measurement results in engineering surveys.												5	2	65% of all students obtain a score of at least 65 (scale 100) .
6	Students are able to prepare engineering survey reports and pay attention to quality control.												5	0	80% of all students obtain a score of at least 70 (scale 100) .

COLLABORATIVE ASSIGNMENT DESIGN

ASSIGNMENT TITLE	Engineering Survey at the UPI Campus
LEARNING METHOD	Case Method
TIME	
ASSESSMENT WEIGHT	30
SUB-CPMK	Students are able to understand and comply with the rules of the lecture, the course syllabus, the course study learning plan, and are able to re-explain the basic concepts of the science, art, and technology of engineering survey.

ASSIGNMENT DESCRIPTION

The Engineering Survey assignment is an activity of collecting data and information used for the planning, design, and construction of an engineering project. The purpose of an engineering survey is to obtain accurate data regarding the physical and topographic conditions of a location in order to support decision-making in the design and implementation of engineering projects, such as the construction of buildings, bridges, roads, or other infrastructure.

TASK COMPLETION STEPS

Survey Planning

- **Determining the Survey Objectives:**
Formulating the specific objectives of the survey, such as for topographic mapping, geotechnical analysis, infrastructure planning, or project feasibility studies.
- **Identification of the Survey Area:**
Determining the boundaries of the area to be surveyed, such as the project site, roads, or development areas.
- **Selection of Survey Methods:**
Selecting the type of survey required (topographic, geotechnical, hydrological, etc.), as well as the appropriate instruments and measurement techniques (GPS, total station, or level).
- **Preparation of Team and Equipment:**
Organizing the survey team, assigning responsibilities, and ensuring that all equipment such as measuring instruments, software, and vehicles are ready for use.

2. Field Preparation

- **Initial Data Collection:**
Collecting basic data about the project location, including maps, satellite imagery, and other relevant data.
- **Control Point Marking:**
Determining and marking control points that will be used as the main reference for measurement and mapping.
- **Preparation of the Field Work Plan:**
Developing a work plan that includes time scheduling, areas to be surveyed, and the sequence of data collection.

3. Field Data Collection

- **Topographic Survey:**
Using instruments such as total stations or GPS to measure land contours, ground elevation, and other physical elements (such as buildings, roads, and rivers).
- **Geotechnical Survey (if required):**
Conducting soil drilling tests, depth measurements, and analysis of soil type and density for foundation design purposes.
- **Hydrological Survey (if required):**
Measuring water flow, drainage channels, and monitoring hydrological conditions such as rainfall, flooding, or flow patterns.
- **Infrastructure Survey:**
Identifying and measuring existing infrastructure elements such as road networks, drainage systems, electrical networks, or other utilities

4. Data Processing and Analysis

- **Data Processing:**
Processing the obtained data using geospatial data processing or CAD software such as AutoCAD, ArcGIS, or Civil 3D.
- **Map and Model Creation:**
Producing topographic maps, digital surface models (DSM), and geotechnical models that describe the physical conditions of the location in detail.
- **Data Analysis:**
Analyzing the data to determine the suitability of the location for the project plan, identifying potential problems (for example, soft soil for foundations, flood risks, etc.), and identifying additional requirements such as drainage or soil reinforcement.

5. Preparation of the Survey Report

- **Survey Report:**
Preparing a report that includes the measurement results, analysis, and recommendations. The report also includes maps, graphs, and figures that illustrate the main findings.
- **Data documentation:**

Topographic Map

- **Description:**
A map that illustrates the contours and shape of the land surface, as well as physical elements such as buildings, roads, rivers, and other areas within the project location.
- **Function:**
Used for terrain analysis, infrastructure planning, and project design that requires topographic data.

2. Geotechnical Map

- **Description:**
A map that shows the geotechnical conditions at the project location, including soil types, soil layer depth, and soil test data (for example, soil bearing capacity and soil density).
- **Function:**
Helps in foundation planning and determining soil stability for construction.

3. Digital Surface Model (DSM)

- **Description:**
A 3D model that represents the contours and elevation of the land surface, obtained from survey results using technologies such as LiDAR or photogrammetry.
- **Function:**
Used for further analysis in the design and planning of infrastructure such as roads, bridges, or drainage channels.

4. Infrastructure Map

- **Description:**
A map that illustrates existing infrastructure elements such as road networks, drainage channels, electrical networks, public facilities, and other utilities within the project area.
- **Function:**
Provides information for transportation system design, utility planning, and mapping of existing assets.

5. Survey Report

- **Description:**
A detailed report that includes measurement results, analysis, and evaluation of field conditions such as topography, geotechnics, hydrology, and infrastructure.
- **Function:**
Provides complete documentation of site conditions that will be used by planners and designers to continue the project.

6. Measurement and Coordinate Data

- **Description:**
Numerical data that records the coordinates of important points measured in the field, including information on distance, angle, and elevation.
- **Function:**
Provides the data required for further modeling and design using engineering software.

7. Recommendations and Analysis

INDICATORS, CRITERIA, AND ASSESSMENT WEIGHTS

Data Accuracy (40%)

- **Indicator:** The level of error in the measurement and coordinate data obtained.
- **Criteria:**
 - Accuracy of coordinate and elevation measurements (for example, an error tolerance ≤ 1 meter for position measurements).
 - Validation of measurement results using existing technical standards or references.
 - Accuracy of the data used in modeling or map production.
- **Weight:** 40%

2. Data Completeness (25%)

- **Indicator:** The extent to which all required elements have been included in the survey.
- **Criteria:**
 - The collected data includes all relevant elements according to the project objectives (for example, land contours, geotechnics, infrastructure, hydrology, etc.).
 - The presence of additional data that may be required for further analysis (for example, data on flood risk, soil conditions, or vegetation).
 - Well-organized data that is easy to access.
- **Weight:** 25%

3. Visual Quality and Presentation (15%)

- **Indicator:** The quality and clarity of the maps, graphs, and models produced.
- **Criteria:**
 - The maps and digital models produced have appropriate formats (for example, proper scale, clear legends, and accurate representation of elements).
 - Presentation of visual data that is easily understood by end users such as engineers, planners, and other related parties.
 - Map design that follows cartographic standards and data visualization principles.
- **Weight:** 15%

4. Survey Methods and Techniques (10%)

- **Indicator:** The suitability of the methods and techniques used in the survey.
- **Criteria:**
 - The selected methods are appropriate for the project objectives (for example, the use of GPS, LiDAR, or total station technology).
 - Survey techniques used follow professional standards and applicable protocols.
 - Effectiveness in the use of available equipment to obtain data efficiently and accurately.
- **Weight:** 10%

5. Report and Documentation (10%)

- **Indicator:** The quality of the survey report and related documentation.
- **Criteria:**
 - The prepared report includes all major data and findings in detail and clearly.
 - Presentation of survey results in an understandable and complete format, including maps, images, and relevant analyses.
 - Additional documentation such as field photographs, survey notes, and data files are arranged neatly and systematically.
- **Weight:** 10%

IMPLEMENTATION SCHEDULE

Description: The number of days in one semester is $16 \times 7 = 112$ days. The implementation schedule can be determined based on the calculation of days.

Activity	Implementation Time
Engineering Survey at the UPI Campus	200

OTHERS

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REFERENCES

1. 1. "Surveying: Theory and Practice" by James M. Anderson and Edward M. Mikhail A comprehensive guide covering the theory and practice of surveying, including both basic concepts and advanced techniques. It's known for its depth and clarity.

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4. 4. "Engineering Surveying" by W. Schofield and Mark Breach This text covers the essential aspects of engineering surveying, including traditional methods and modern techniques like GPS and GIS.

5. 5. "GPS for Land Surveyors" by Jan Van Sickle A focused guide on GPS technology, a key tool in modern surveying. This book is particularly useful for students wanting to deepen their understanding of GPS applications in surveying.

6. 6. "Geodesy: The Concepts" by Petr Vanířek and Edward Krakiwsky For those interested in the theoretical aspects of surveying, particularly geodesy, this book offers a strong foundation in the concepts of earth measurements.

7. 7. "Adjustment Computations: Spatial Data Analysis" by Charles D. Ghilani This book is excellent for understanding the statistical adjustments in surveying, including least squares adjustments, error analysis, and other advanced topics.