



Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Civil Engineering	Semester	Third Semester
Course Code	20CE32P	Type of Course	Programme Core
Course Name	Modern Surveying	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L: T:P:: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale Civil engineering is one of the oldest engineering disciplines in the world. In the era of globalization today, technology has brought significant advancements in surveying instruments and technology. Available precise digital surveying instruments are used in the field of civil engineering currently due to their accuracy, speed and easy operation. Since remote sensing, GIS, GPS, photogrammetric survey is a vital discipline and being widely used for plotting and storing spatial information, it is expected the students should know the basics of the same to apply it in the field. Through this course students will develop the desired skills and competencies which are expected from them for survey related works.

2. Course Outcomes/Skill Sets: At the end of this course students will be able to:

CO-01	Select and explain the use of the right instrument for surveying a given area, structure and/or topography.
CO-02	Prepare an area map for a specific construction activity by measuring distances, angles, choosing the right bearings, relative position and contours using the appropriate instrument(s).
CO-03	Calculate heights of different structures, relative altitudes and distances of different points on ground using appropriate instruments.
CO-04	Use GPS, remote sensing, advanced instruments and other techniques for surveying of specific areas.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	01 02 03	1,2, 4,7	1. Contours, Importance of contour maps. Characteristics of contours.	1. Study the contour maps	1. Conduct block contouring for a minimum area of

			<p>2. Methods of plotting contours. Factors affecting contour interval.</p> <p>3. Method of preparing contour map from the given RLs of grid points with examples.</p>	<p>of different topography.</p> <p>2 Study the Uses of Contours in civil engineering field</p> <p>3 Measure the volume of Reservoir from contour maps.</p>	<p>40 m x 40 m to draw its contour plan at a suitable contour interval.</p> <p>2. Find out the area enclosed by the contours using AutoCAD.</p>
2	1	1,2,4,7	<p>1. Component parts of transit theodolite and their functions.</p> <p>2. Reading the vernier, Salient features and relationship between the fundamental axes of transit theodolite.</p> <p>3. Technical terms used. Temporary adjustments.</p>	<p>1. List the Applications of different types of theodolites.</p>	<p>1. Measure horizontal angle between the given points.</p> <p>2. Measure vertical angle between the given points.</p>
3	1	1,2,4,7	<p>1. Theodolite traversing. Open and Closed Traverse.</p> <p>2. Theodolite traversing by included angle method and deflection angle method.</p> <p>3. Checks for open and closed traverse, Calculation of bearing from angles. Traverse computation-Latitude, Departure.</p>	<p>1. Study the Consecutive coordinates, independent coordinates.</p> <p>2. Balance the traverse using spreadsheet by Bowditch rule or Transit rule.</p> <p>3. Conduct Contouring using Theodolite.</p>	<p>1. Measure horizontal angle by repetition and reiteration method.</p> <p>2. Carry out survey project for closed traverse for minimum 5 sides by locating details using theodolite.</p>
4	2	1,2,4,7	<p>1. Trigonometrical Survey and its applications.</p> <p>2. Elevations and Distances of accessible points whose base is accessible-Single plane method-Simple problems.</p> <p>3. Elevations and Distances of inaccessible points whose base is inaccessible-Single plane method-Simple problems.</p>	<p>1. How do we measure heights of mountains?</p> <p>2. Measure height of inaccessible high-rise towers.</p>	<p>1. Measure height of an object whose base is accessible.</p> <p>2. Measure height of an object whose base is inaccessible.</p>

5	2	1,2,4,7	<p>1. Tachometer: Principle of tachometry and component parts. Analytic lens</p> <p>2. Tachometric formula for horizontal distance with telescope horizontal and staff vertical.</p> <p>3. Method of determining Horizontal and vertical distances with tachometer by fixed hair method and staff held vertical.</p>	<p>1. List the applications of Tachometric survey.</p> <p>2. List the limitations of tachometry.</p>	<p>1. Determine Tachometric constants.</p> <p>2. Calculate the reduced levels and horizontal distances of given points using tachometer.</p>
6	3	1,2,4,7	<p>1. Total Station: Introduction, Integral parts, Applications.</p> <p>2. Working principle, Advantages, Disadvantages.</p> <p>3. Use of function keys. Precautions to be taken while using a Total Station.</p>	<p>1. List the Applications of different types of Total Stations.</p> <p>2. Differentiate between theodolite and Total station.</p>	<p>1. Component parts and General commands used.</p> <p>2. Instrument preparation and setting up.</p>
7	3	1,2,4,7	<p>1. Setting up a back sight. Azimuth mark, control point. Change point - procedure to shift change point and precautions to be taken. General settings.</p> <p>2. Automatic Target Recognition, Field Book recording, Radial Shoot.</p> <p>3. Survey Station Description (codes). Occupied point (Instrument Station) Entries.</p>	<p>1. Calculate Height using Trigonometric survey and compare results with total station.</p>	<p>1. Find out the Horizontal angle, Vertical angle of given points.</p> <p>2. Find out the distance, gradient and difference in height between two inaccessible points using Total Station.</p>
8	3	1,2,4,7	<p>1. 3D coordinates: By Resection. Coordinate calculation. Offset: Single distance offset.</p> <p>2. Data Retrieval, Field Generated Graphics. Data Gathering Components, Data Processing Components of the system.</p> <p>3. Data plotting, Field computers, Modem for data transfer.</p>	<p>1. Compare and prepare report on accuracy of results between Theodolite and Total Station.</p>	<p>1. Stake out using Total Station- Find a specific point and its coordinates in the field.</p> <p>2. Find out the height of a remote point like tip of a transmission tower or chimney using Total Station.</p>
9	3	1,2,4,7	<p>1. Interfacing the Data Collector with a Computer, Digital Data.</p>	<p>1. Compare and prepare a report on time requirements</p>	<p>1& 2: Prepare a topographic sketch of a given area using Total station and plot the</p>

			<p>2. Digital transfer of data to Application software. Requirements of a data collector.</p> <p>3. Calibrating the Instrument Equipment maintenance, Maintaining battery power.</p>	to complete a particular activity by Total Station with other equipment.	contour plan using AutoCAD / Civil 3D/ Auto plotter.
10	3	1,2,4,7	<p>1. Total station survey system error sources and how to avoid them.</p> <p>2& 3. Controlling errors.</p>	<p>1. How Data is transferred from Total Station to other electronic devices.</p> <p>2. Collect the survey sketch of any place and mark the boundaries and determine the area using total station</p>	<p>1. Conduct a closed traverse for a given area using Total Station. (Including minimum two change points)</p> <p>2. Plot the area map of the closed traverse conducted using AutoCAD and Find the area.</p>
11	4	1,2,4,7	<p>Construction Layout Using Total Station</p> <p>1. How to set control points around the layout site.</p> <p>2. How control points and coordinates are used to set out the position of buildings (how the positions of the actual structures are fixed and site profiles to guide the excavation and pouring concrete into the foundations)</p> <p>3. Setting up site profiles and sight rails for Drainage.</p>	<p>List the points that should be kept in mind while using Total station during the operation of</p> <p>a. Levelling b. Measuring distances c. Measuring angles. d. Contouring</p>	<p>1. Set out control points for centre line marking of a building using the total station.</p> <p>2. Set out control points for laying of pipeline using total station.</p>
12	4	1,2,4,7	<p>1. Aerial Surveying, GPS: Introduction, Applications. Positioning methods, Errors and Limitations in GPS. applications of Google maps in civil Engineering.</p> <p>2. Remote Sensing: Introduction, Basic components of remote sensing, energy interaction with the earth surfaces.</p>	<p>1. How the Remote sensing Interpretation is done?</p> <p>2. Study the classification, applications, advantages & Disadvantages</p>	Virtual Media and Field Visit

			3. Applications of remote sensing in mining, land use/land cover, mapping, disaster management and environment.	of GPS surveying 3. Prepare a Technical Report on Field Visit.	
13	4	1,2, 4,7	1. GIS: Overview, components Applications and Limitations. 2. Drone Surveying: Overview, Applications and Limitations. 3. Lidar: Overview, Applications and Advantages. Hyper spectral Imagery.	1. What is the need of GIS for civil engineers? 2. Prepare a Technical Report on Field Visit.	Virtual Media and Field Visit
Total in hours			39	13	52

NOTE 1: The course content shall be delivered through lectures, PowerPoint presentations, video demonstrations and field visits.

NOTE 2: The TUTORIAL (Activity criteria) shall be conducted / executed by the student (Minimum ONE suggested activity from each week) and to be submitted in portfolio evaluation of activities through rubrics to the faculty.

NOTE 3: The PRACTICE (Performance criteria) shall be conducted by the student and observations and report to be submitted at the end of each session to the faculty.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					100

5. Format for CIE written Test

Course Name	Surveying	Test	I/II/III	Sem	III/IV
Course Code	20CE32P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks

I	1			
	2			
II	3			
	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Duggal, S. K., Surveying Vol. I & II , Tata Mcgraw Hill, New Delhi
2	Subramanian, R., Surveying & Levelling , Oxford University Press, New Delhi
3	Punamia, B.C., Surveying Vol. I, II & III , Laxmi Publications
4	Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II , Pune Vidyarthi Gruh
5	Arora, K.R., Surveying Vol. I, II & III , Standard Book House. New Delhi
6	Basak, N.N., Surveying and Levelling , Tata Mcgraw Hill, New Delhi
7	A. Bannister, S. Raymond, R. Baker, "Surveying" , Pearson, 7th ed., NewDelhi
8	Agor, R., Surveying and Levelling , Khanna Publishers, New Delhi
9	Agor, R. Advanced Surveying , Khanna Publishers, New Delhi

10	Roy, S.K., Fundamentals of Surveying , Prentice Hall India, New Delhi
11	Remote Sensing and GIS by B Bhatia , Oxford University Press, New Delhi.
12	Remote sensing and Image interpretation by T.M Lillesand, R.W Kiefer and J.W Chipman , 5th edition, John Wiley and Sons India
13	Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems , Prentice Hall of India, New Delhi, 2002
14	Anji Reddy, M., Remote Sensing and Geographical Information Systems , B.S.Publications, Hyderabad, 2001

8. a. CIE Skill Test 1- Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Portfolio evaluation for practice sessions -Performance criteria (Observations and report)	10
2	<p>Experiment on theodolite</p> <p>a. Measurement of horizontal angle (Repetition or Reiteration method)/ measurement of Vertical angle using theodolite.</p> <p style="text-align: center;">OR</p> <p>b. Carry out closed traverse for minimum 5 sides including locating details using theodolite.</p> <p>(i) Writing Field Procedure, formula and tabular column -10 marks</p> <p>(ii) Setting and conduction - 20 marks</p> <p>(iii) Observations, Recordings and calculations-15 marks</p> <p>(iv) Interpretation of result and Plotting- 05 marks</p>	50
3	<p>a. Measure height of an object whose base is accessible / inaccessible by Trigonometrical survey.</p> <p style="text-align: center;">OR</p> <p>b. Determine Tachometric constants / Calculate the reduced levels and horizontal distances of given points by tachometric survey</p> <p>(i) Writing Field Procedure, formula and tabular column -05 marks</p> <p>(ii) Setting and conduction - 10 marks</p> <p>(iii) Observations, Recordings and calculations-10 marks</p>	30

	(iv) Interpretation of result and Plotting- 05 marks	
4	Viva-Voce	10
Total Marks		100

Note for the Examiner:

1. The choice between the questions 2a and 2b shall be done by the examiner.
2. The choice between the questions 3a and 3b shall be done by the examiner.

8. b. CIE Skill Test 2 - Scheme of evaluation

SL. No.	Particulars/Dimension	Marks
1	Portfolio evaluation for practice sessions -Performance criteria (Observations and report)	10
2	<p>Experiment on total station.</p> <p>a. Find out the Horizontal angle/ Vertical angle/ distance/gradient/difference in height of given points using total station.</p> <p style="text-align: center;">OR</p> <p>b. Find a specific point and its coordinates in the field/ height of a remote point using Total Station.</p> <p>(i) Writing Field Procedure, formula and tabular column -10 marks</p> <p>(ii) Setting and operation - 10 marks</p> <p>(iii) Observations, Recordings and calculations-10 marks</p> <p>(iv) Interpretation of result and Plotting- 10 marks</p>	40
3	<p>Experiment on total station.</p> <p>a. Prepare a contour plan of a given area using Total station and plot it using CADD.</p> <p style="text-align: center;">OR</p> <p>b. Form a closed traverse using Total Station, Plot the area map using CADD and find the area of closed traverse</p> <p>(i) Writing Field Procedure, formula and tabular column -10 marks</p> <p>(ii) Setting and operation - 10 marks</p> <p>(iii) Observations, Recordings and calculations-10 marks</p>	40

	(iv) Interpretation of result and Plotting- 10 marks	
4	Viva-Voce	10
Total Marks		100

Note for the Examiner:

1. The choice between the questions 2a and 2b shall be done by the examiner.
2. The choice between the questions 3a and 3b shall be done by the examiner.

8. c. SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	a. Experiment on theodolite (i) Writing Field Procedure, formula and tabular column -10 marks (ii) Setting and conduction - 15 marks (iii) Observations, Recordings and calculations-10 marks (iv) Interpretation of result and Plotting- 05 marks	40
2	Experiment on total station (i) Writing Field Procedure, formula and tabular column -10 marks (ii) Setting and operation - 15 marks (iii) Observations, Recordings and calculations-10 marks (iv) Interpretation of result and Plotting- 05 marks	40
3	Viva-Voce	20
Total Marks		100

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
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1	Dumpy Level with accessories	Length of Telescope: 300mm. Length: 215mm Short Distance:1.5m Objective aperture: 32mm	4
2	Auto Level with accessories	Accuracy (MM): 1/16 in. per km Double-run (2.0 mm), Magnification: Choice of 24x, 28x, 32x, Operating Temperature Range: -4 to +122 Deg F (-20 to +50 Deg C), Diameter of Objective: 1.26 in. (32 mm), Field of View: 2.5 ft. at 100 ft. (1 Deg 25 Feet)	4
3	Telescopic Levelling staff 5M	Material: Aluminium. Measuring Range: 1M/Unit. Resolution: 2cm	4
4	Ranging rod 2m	Circular / Octagonal Ranging Rods preferably circular with 3 to 5 cm diameter made up of either seasoned solid bamboo stick or metal conduit pipe of length 2 to 3 meters, with conical metallic shoe fitted at bottom & fully painted with 20 cm. long colour bands of either of the following combinations. Salient Features: a) Black & White - size 2 meters. b) Red & White - size 3 meters	5
5	Arrows	Material: Steel Ringed. Top:35 mm Colour: Red & White	6
6	Engineers Chain	Chain-30 Mtr or 100 Feet in 100 Links in Metal Tags & Rings & Brass Handle Material: MS Wire & Brass	4
7	Measuring Tape 15m	Tapes Type Fibreglass Measurement Tape Colour Grey	4
8	Prism and prism pole	Colour: Red, Material: Aluminium, Accuracy:< 5 Second, Offset:0/-30mm, Thickness:64 mm	2

9	Total Station	Magnification 24x, Field of View 1-30-inch, Minimum Focusing Distance 1.5 Meter, Single Prism Distance Measurement 4.0 Km, Accuracy 3mm +2ppm	2
10	Prismatic compass with stand	Aluminium Prismatic Compass, Packaging Type: Carton Box, Size/Diameter: 4 Inch, Weight 539 grams	4
11	Twenty Second Transit Theodolite with accessories.	Angle Measurement Accuracy 20 secs, Display Panel Single Side, Magnification 30x, Measuring Time 30 Sec, Field of View 2.6 m at 100 meters	4
12	Electronic Digital Theodolite with accessories.	Digital Theodolite - Geomax ZIPP 02, For Survey, (hz, V), Model Name/Number ZIPP 02, Brand Geo max zipp 02, Angle Measurement Accuracy (Hz, V), Colour yellow, Battery Operation charger	4
13	Handheld GPS navigator	Screen Size 3.5 Inch, Type Wireless, Usage Land Survey, Width 69 mm, Depth 30 mm	4
14	Wooden Pegs	Finish Rustic, Colour Brown, Length 2-5 Feet	6
15	Computers	Dell Optiplex 19 inch, All in One Desktop Set: Intel i5 3470, 8GB, 500GB HDD, 19 inches HD Monitor, Keyboard, Mouse, HD Webcam, Mic, Speakers, Wi-Fi, Display Port, Windows 10 Pro, MS Office	10
16	CADD software	AutoCAD LT	1