DARBHANGA COLLEGE OF ENGINEERING, DARBHANGA

COURSE FILE OF

SURVEYING AND GEOMATICS(101308)

Faculty:

Mr. Akash

Assistant Professor

Department of Civil Engineering

CONTENTS

DARBHANGA COLLEGE OF ENGINEERING, DARBHANGA

DEPARTMENT OF CIVIL ENGINEERING

Vision

To bring forth competent engineers to serve national & multi-national industries and society and, encouraging them towards higher studies.

Mission

M1. To nurture graduates into competent and technologically capable professionals through motivated teaching-learning ambience and by collaborating with relevant industries.

M2. To encourage graduates towards research and innovation in the field of civil engineering.

M3. To inculcate humanitarian ethical values in graduates through various social-cultural activities.

Program Educational Objectives (PEOs)

PEO1. The graduates will be able to demonstrate knowledge and skills of civil engineering to solve engineering problems related to structural design.

PEO2. The graduates will be able to function in the evolving research and development as design consultant in the relevant industry using modern software tools.

PEO3. The graduates will be able to showcase professional skills encompassing societal and ethical values.

Program Specific Outcomes (PSO)

PSO1: Students will be able to use advanced modern methods and tools like GIS, Auto CAD, STAAD Pro, Total station to function as design consultants.

PSO2: Graduates will able to develop knowledge in some specific technical areas of civil engineering like Structural, Geotechnical, Transportation, Earthquake, Geomatics and Environmental Engineering.

Program Outcomes (POs):

Program Outcomes (POs) describe what students are expected to know and be able to do by the time of graduation to accomplish Program Educational Objectives (PEOs). The Program Outcomes for Civil Engineering students are:

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in the field of civil engineering.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex civil engineering activities with an understanding of the limitations.

PO 6: The Engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the civil engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Objective

With the successful completion of the course, the student should have the capability to:

- describe the function of surveying in civil engineering construction,
- Work with survey observations, and perform calculations,
- Operate an automatic level to perform differential and profile levelling; properly record notes; mathematically reduce and check levelling measurements,
- Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments,
- Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse,
- Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse. Use appropriate software for calculations and mapping,
- Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system,
- Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

COURSE OUTCOMES (COs):

After the completion of this course, students will be able to ;

CO1: Learn about basics involved in different types of surveying like tape, compass, levelling, and theodolite (total station).

CO2: Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

CO3: Setting out horizontal and vertical curves

CO4: Operate survey instruments to measure distance, angles, and to calculate differences in elevation.

C05: Apply the concept of remote sensing and global positioning system

CO-PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1: Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).	S	S	-	S	M	-	M	-	-	S	-	-	S	S
CO2: Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities	S	S	-	S	S	-	M	-	-	S	-	-	S	S
CO3: Setting out horizontal and vertical curves	S	S	-	S	S	-	-	-	-	M	S	-	S	S
CO4: Operate survey instruments to measure distance, angles, and to calculate differences in elevation.	S	S	-	S	S	-	-	-	-	S	-	-	S	S
CO5: Apply the concept of remote sensing and global positioning system	S	S	-	W	M	-	-	-	-	S	S	-	S	S

B. Tech. 2nd Year (3rd Semester)

Department of Civil Engineering

Subject Code – 101308

Subject – Surveying and Geomatics

Max Mark (Theory) :	100 Marks	Max Mark (Practical) : 50	
End Sem :	70 Marks	Viva-voce (Internal) :20	
Mid Sem :	20 Marks	Viva-voce (External) :30	
Class Test/ Attendance/Assignments:	10 Marks		

L	T	P	CREDIT
2	0	2	3

Syllabus:

Module 1:

Introduction to Surveying (8 hours):

Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.

Triangulation and Trilateration (6 Hours):

Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation network- Signals. Baseline - choices - instruments and accessories - extension of base lines corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric levelling - Axis signal corrections.

Module 2:

Curves (6 hours):

Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves

Module 3:

Modern Field Survey Systems (8 Hours):

Principle of Electronic Distance Measurement, Modulation, and Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications,

Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

Module 4:

Photogrammetry Surveying (8 Hours):

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods;

photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

Module 5:

***Remote Sensing (9 Hours)*:**

Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

Text/Reference Books:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

GATE Syllabus

Geomatics:

Engineering Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Photogrammetry - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).

Darbhanga College of Engineering

3rd Semester w.e.f:

DAY	Dept.	09:00-11:00	11:00-01:00	01:00-02:00	02:00-5:00
MONDAY	EEE	EMFT	ECA		√. EM-I Lab
	CE	BIO	Humanity		√.Survey & Geomatics LAB
	CSE	√. AE Lab	DS		√. DS Lab
	ME	TD	BE		Virtual EM Lab - M1
TUESDAY	EEE	EM-I	DE		REMIDAL CLASSES
	CE	Survey & Geomatics	EM		√. BE LAB
	CSE	√. DS Lab	OOPS		REMIDAL CLASSES
	ME	EM	MATH-III		Virtual MD Lab
WEDNESDAY	EEE	EM	ECA		REMIDAL CLASSES
	CE	ICE	M-III		√. CACED LAB
	CSE	√. OOPS Lab	DS		Internship
	ME	BE(T1)	√REMIDAL LAB		MATH-III
THURSDAY	EEE	DE	EMFT		√. EM-I Lab
	CE	INTERNSHIP	EM		√. Survey & Geomatics LAB
	CSE	Tech. Writing	OOPS		√. OOPS Lab
	ME	BIO	MATH-III		Virtual EM Lab - M2
FRIDAY	EEE	HVPE	EM-I		Internship
	CE	Humanity	CACED		Project
	CSE	MIII	AE		√. AE Lab
	ME	TD	EM		Virtual MD Lab
SATURDAY	EEE	EM	HVPE		Project
	CE	BE	INTERNSHIP		REMIDAL CLASSES
	CSE	AE	MIII		REMIDAL CLASSES
	ME	BIO	BE		REMIDAL CLASSES

EEE (3rd Sem)

SN.	Subject	Faculty
1	ECA	Mr. Diwakar Verma
2	EM-I	Mr. Prabhat Kumar
3	DE	Ms. Sweta Kumari
4	EM	Mr. Vikash/Dr. Abhishek
5	EMFT	Dr. Ravi Ranjan/Mr. Ravi Kumar
6	HVPE	Dr. Ratnakshi Roy
7	CD Project	All faculty
8	Intership	All Faculty
9	MOOCS	All Faculty

ME (3rd Sem)

SN.	Subject	Faculty
1	MATH-III	GL-I (MATH)
2	EM	Mr. Vikash Kumar
3	TD	Mr. Navdeep Pandey
4	BE	Mr. Deepak Singh
5	MD	Dr. Md. Asjad Mokhtar
6	BIO	GL (BIO)

CE (3rd Sem)

SN.	Subject	Faculty
1	BE	Mr. Deepak Kumar
2	BIO	Kumari Neeraj
3	CACED	Mr. Akash
4	EM	Mr. S. S. Chhoudhary
5	S & Geomatics	Mr. Akash
6	M-III	Dr. R. K. Jha
7	Humanities-I	Dr. Ratnakshi Roy
8	ICE	Mr. Ahsan Rabbani
9	Internship	All Faculty

CSE (3rd Sem)

SN.	Subject	Faculty
1	DS	Mis. Poonam Prabha
2	OOPS	Mr. Dhirendr Kumar
3	MIII	Mr. Amrit Mahato
4	Tech. Writing	
5	CD Project	All faculty
6	Intership	Mr. Dhirendr Kumar
7	MOOCS	Mr. Anand Kamal

15/07/2020
for.
HOD (EEE)

15/07/2020
HOD (CE)

15/07/2020
HOD (ME)

15/07/2020
HOD(CSE)

15/7/2020
Asst. Routine Incharge

15/7/2020
Routine Incharge

15/07/2020
Principal
DCE Darbhanga

List of Students (2019-2023) 3rd Semester		
SI. No.	**Registration No.**	**Name of Student**
1	18101111003	Abhishek Sagar
2	18101111013	Raushan Kumar
3	18101111022	Suraj Kumar
4	18101111026	MD Shamshad Alam
5	18101111042	Niranjan Kumar
6	18101111044	Ravi Kumar
7	18101111048	Vikash Kumar
8	19101111001	Prabhat Kumar
9	19101111002	Vikash Chandra
10	19101111003	Raja Kumar
11	19101111004	Akshansh Ranjan
12	19101111005	Sonam Kumari
13	19101111006	Avinash Kumar
14	19101111007	Ankit Kumar
15	19101111008	Sarvesh Suman
16	19101111009	Nagendra Safi
17	19101111010	MD Shahbaz
18	19101111011	Abhinav Bhardwaj
19	19101111012	Abhishek Kumar
20	19101111013	Anshu Kumari
21	19101111014	Dilkhush Kumar
22	19101111015	Mantu Kumar
23	19101111016	Ajesh Kumar
24	19101111017	Rupesh Kumar
25	19101111018	Kundan Kumar
26	19101111019	Suraj Kumar
27	19101111020	Sahil Kumar
28	19101111021	Vicky Kumar
29	19101111022	Pintu Kumar
30	19101111023	Durgesh Kumar
31	19101111024	Rishabh Kumar
32	19101111025	Abhay Kumar
33	19101111026	Navin Prakash
34	19101111027	Saurav Samdarshi
35	19101111028	Avinash Kumar
36	19101111029	Amit Raj

37	19101111030	Kunal Kishor
38	19101111031	MD Ragib Hasan
39	19101111032	Sumit Raushan
40	19101111033	Anisha
41	19101111034	Aradhana Kumari
42	19101111035	Suraj Kumar
43	19101111036	Bharat Kumar
44	19101111037	Alok Kumar Singh
45	19101111038	shyam salone
46	19101111039	Sandhya Bharti
47	19101111040	Shailesh Kumar
48	19101111041	Rajnikant Kumar
49	19101111042	Sumit Anand
50	19101111043	Subodh Kumar
51	19101111044	Gautam Kumar
52	19101111045	Rohit Kumar Mishara
53	19101111046	Vishaka Kumari
54	19101111047	Ankit Kumar Pandey
55	19101111048	Saquib Johar
56	19101111049	Prakash Kumar
57	19101111050	Ranveer Kumar
58	19101111051	Avinash Shivam krishna
59	19101111052	Abhinandan Kumar
60	19101111053	Rohit Kumar
61	19101111054	Ram Vinay Yadav
62	19101111055	Abhishek Ranjan
63	19101111056	Avinash
64	19101111057	Ranjan kumar Bhagat
65	19101111058	Mayank Kumar
66	19101111059	MD Aatif Raza
67	19101111060	Prince Kumar
68	20-LE-CE-01	Prafull Singh
69	20-LE-CE-02	Ashish Kumar Bharti
70	20-LE-CE-03	Vijay Shekhar
71	20-LE-CE-04	Vikram Ray
72	20-LE-CE-05	Arpit Kumar
73	20-LE-CE-06	Raushan Prasad Singh
74	20-LE-CE-07	Sannidev Kumar Ram
75	20-LE-CE-08	Aman Kumar

Institute/College Name:	Darbhanga College of Engineering, Darbhanga
Program Name:	B.Tech (CE, 3rd semester)
Course Code:	101308
Course Name:	Surveying and Geomatics
Lecture/Tutorial (per week):	2/0
Course Credits:	3
Course Co-ordinator Name:	Mr. Akash

LECTURE PLAN:

Sl. No.	Unit No.	Topic No.	Topic
1	1	1.1	Introduction to Surveying: Definition, Principles, classification, Scale
		1.2	Linear Methods : Chain Surveying; Introduction , Principles, Methods, Obstacles
		1.3	Angular Methods: Compass Surveying; Bearing of a line, Local Attraction, Magnetic Declination
		1.4	Graphical Methods: Plane Table Surveying: Instruments, Principle, methods, Advantages
		1.5	Direct Levelling: Principles of levelling- booking and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling
		1.6	Contouring: Characteristics, methods, uses; areas and volumes.
		1.7	Trigonometric levelling - Axis single corrections.
		1.8	Theodolite survey: Instruments, Measurement of horizontal and vertical angle;
		1.9	Triangulation and Trilateration: Horizontal and vertical control - methods -triangulation network- Signals. Baseline - choices - instruments and accessories - extension of base lines corrections - Satellite station - reduction to centre - Intervisibility of height and distances -
2	2	2.1	Introduction of Curve: Definition, Uses, Types
		2.2	Elements of simple Curve and Setting out of Simple circular Curve
		2.3	Compound Curve and its setting out

		2.4	Reverse Curve and Its setting out
		2.5	Transition Curve – Length and Element of transition curve
		2.6	Vertical Curve- Length, Element and setting out
3	3	3.1	Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat
		3.2	Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey;
		3.3	Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.
4	4	4.1	Photogrammetry Surveying : Introduction, Basic concepts
		4.2	Perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial
		4.3	Triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes
5	5	5.1	Remote Sensing (9 Hours): Introduction –Electromagnetic Spectrum, ,;
		5.2	Interaction of electromagnetic radiation with the atmosphere and earth surface
		5.3	Remote sensing data acquisition: platforms and sensors, visual image interpretation; digital image processing.

DARBHANGA COLLEGE OF ENGINEERING, DARBHANGA

(Department of Civil Engineering)

ASSIGNMENT -01 (Module-1 and Module -2)

B.Tech 3rd Semester (2019-23)

Chain Surveying

1) A 30 m chain was found to be 12 cm too long after chaining a distance of 1750 m. It was found to be 23 cm too long at the end of day's work after chaining a total distance of 3600 m. Find the true distance if the chain was corrected before the commencement of the work.

2) A nominal distance of 30 m was set up with a 30 m steel tape from a mark on the top of one peg to a mark on the top of another, the tape being in catenary under a pull of 10 kg and at a mean temperature of 70^0 F. The top of one peg was 0.25 m below the top of the other. The top of the higher peg was 460 m above mean sea level. Calculate the exact horizontal distance between the marks on the two pegs and reduce it to mean sea level, if the tape was standardized at a temperature of 60^0 F, in catenary, under a pull of 12 kg. Take radius of earth =6370 km, Density of tape = 7.86 g/cm^2

Compass Surveying

1) Find which stations are affected by local attraction and work out correct bearings of the lines of a closed traverse ABCDEA.

Line	F.B.	B.B.
AB	$191^0$30'	$13^0$00'
BC	$69^0$30'	$246^0$30'
CD	$32^0$15'	$210^0$30'
DE	$262^0$45'	$80^0$45'
EA	$230^0$15'	$53^0$00'

2) In an anticlockwise closed traverse ABCA all the sides were equal. Magnetic fore bearing of BC was obtained to be $15^0$30'. The bearing of sun was observed to be $184^0$30' at local noon with a prismatic compass. Calculate the magnetic bearings and true bearings of all the sides of the traverse. Tabulate the results and draw a neat sketch to show the true bearings.

Plane Table Surveying

1) State principle, advantage, disadvantage of plane table surveying.
2) Explain three point and two point problems in plane tables surveying.
3) Explain the procedure of plane table surveying.

Levelling

1) Following reciprocal readings were taken with dampy level. Find
   (a) True difference in level; (b) True RL of Q; (c) Refraction correction; (d) Combined correction; (e) Collimation error, (whether the line of collimation is inclined upwards or downwards) (f) Collimation error in 100 m.

Instrument at	*Staff reading on*		*Remarks*
	P	***Q***	
P	1.155	2.595	Distance PQ = 500 m
Q	0.985	2.415	RL of P = 525.50 m

2) The following data shown as (x) in table of a level are illegible owing to the exposure of sudden rainfall. Find the missing data. Rebook all the data and check your answer.

Station	BS	IS	FS	HI	RL	Remarks
1	X			134.600	132.385	BM
2		X			132.995	
3	2.080		0.985	X	X	CP_1
4		X			132.940	
5	0.605		X	X	134.440	CP_2
6		X			133.070	
7		1.045			X	
8			X		132.360	RL of last station

3) A page of level field book partially defaced is reproduced. Calculate the missing entries marked with a cross(x) .

Station	BS	IS	FS	Rise	Fall	RL	Remarks
1	1.200					100.00	BM
2		X			0.650	X	
3	1.350		1.565	X		X	CP_1
4		X		0.085		X	
5	X		X		X	X	CP_2
6		X		X		100.240	
7			2.250		X	99.150	
Total	4.415		X	1.075	X		

Contouring

1) Explain the different methods for calculation of area of a closed traverse from co-ordinates.
2) Explain the prismoidal and curvature correction for volumes.

Trigonometrical Levelling

1) To determine the elevations of the top of chimney following observations were made:

Station	Reading on B.M.	Angle of elevation
P	2.870	$28^0 42'$
Q	3.750	$18^0 06'$

The top of chimney and the stations P and Q are in the same vertical plane, PQ is 10 m. If the R.L. of the B.M. is 100.00, determine the elevation of the top of the chimney.

Simple Circular Curve

1) Two straights intersect at a chainage 1280 m, deflection angle being 32^0. Calculate necessary data for setting out a circular curve of radius 201m, by deflection angle method for peg interval of 20 m chain.

Compound Curve

1) Two straights AB and BC intersect at B, another line PQ intersects AB and BC at point P and Q, the radius of the first curve is 250 m and the second is 350 m. The chainage of B is 1200 m and deflection angle of first and second curve being 30^0 and 35^0. Calculate necessary data for setting out a compound curve by deflection angle method.

Reverse Curve

1) While surveying along the alignment of a road, the bearing of the lines AB, BC and CD are measured as 85^0, 115^0 and 65^0 respectively. The length of BC is 250 m, and the chainage of B is 1000.00 m. Calculate necessary data required for setting out a reverse curve connecting the line AB and CD by taking BC as the common tangent. The radii of both the curves may be assumed same.

Transition Curve

1) Describe transition curve and its types. How do you calculate the length of transition curve?

Vertical Curve

1) Calculate the data required for setting out vertical curve for given data:
   (i) Two grades; + 0.6% and – 0.6 %
   (ii) Chainage of intersection point = 630 m.
   (iii) RL of intersection point = 355.50 m.
   (iv) The rate of change of grade is 0.1 % per 30 m.

Department of Civil Engineering

B.Tech. 3rd Semester Mid-Exam. 2020

Course: Surveying and Geomatics

Code : 101308

Time: 2 hours **Full Marks: 20**

Instructions: Answer all questions.

1. (a) If a line of 5 cm has shrunk to 4.5 cm, determine correct area corresponding to a measured area of 81 m^2. 2

   (b) Convert the following whole circle bearings into quadrantal bearings:

   (i) $30^0$30' (ii) $109^0$18' (iii) $216^0$35' (iv) $274^0$50' 1

   (b) Convert the following quadrantal bearings into whole circle bearings:

   (i) N $12^0$45' E (ii) S $19^0$50' E (iii) S $30^0$30'W (iv) N $74^0$10' W 1

2. When the level was set up near A, the staff readings on A and B were 3.415 m and 4.532 m respectively. When the level was set up near B, the respective staff readings were 1.865 m and 4.012 m. Find the true difference of level A and B. What is the RL of B, if that of RL of A is 151.50 m? 4

3. A chain line ABC crosses a river at 90^0 . B and C are two points located at the near and far ends of banks, respectively; AB = 53.34 m, BD = 90 m and <ABD = 90^0 . The WCB of C and A taken at D are 30^0 and 120^0 respectively. Find the width of river. 4

4. The following are the bearings of the lines of the closed traverse ABCDA taken with a compass in a place where local attraction was suspected. Correct the bearings of the lines for local attraction 4

Line	F.B.	B.B
AB	35°30'	215°30'
BC	115°15'	294°15'
CD	180°45'	3°45'
DA	283°45'	101°45'

5. (a) Describe the elements of simple circular curve with neat sketch. 3

   (b) List the linear and angular methods of setting out of simple circular curve. 1

Code : 101308

B.Tech 3rd Semester Exam., 2019
(New Course)

SURVEYING AND GEOMATICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer (any *seven*) : 2×7=14

(a) On a turning point in levelling operation

(i) only a backsight is taken

(ii) only a foresight is taken

(iii) Both *(i)* and *(ii)*

(iv) an intersight is taken

(b) Method of repetition for angle measurement can be used in measurement of

(i) vertical angle

(ii) horizontal angle

(iii) Both *(i)* and *(ii)*

(iv) None of the above

(c) Cross-staff is used to set

(i) acute angle

(ii) obtuse angle

(iii) staff reading

(iv) right angle

(d) A negative declination shows that the magnetic meridian is to the

(i) West of true meridian

(ii) East of true meridian

(iii) South of true meridian

(iv) North of true meridian

(e) The curvature error and atmospheric refractions are eliminated by

(i) simple levelling

(ii) differential levelling

(iii) stadia levelling

(iv) reciprocal levelling

(f) To compute area of a figure bounded by straight lines, the figure is generally converted into a network of

(i) squares

(ii) triangles

(iii) rectangles

(iv) trapezium

(g) Which one of the following factors does not affect the relief displacement of an object in aerial photographs?

(i) Focal length

(ii) Flying height

(iii) Height of the object

(iv) Type of aerial camera

(h) The altitudinal distance of the GPS satellites from the earth is about

(i) 20200 km (ii) 30000 km

(iii) 36000 km (iv) 44000 km

(i) Which of the following statements is not correct concerning refraction of the GPS signal in the troposphere?

(i) L1 and L2 carrier waves are refracted equally.

(ii) When a GPS satellite is near the horizon, its signal is most affected by the atmosphere.

(iii) The density of the troposphere governs the severity of its effect on a GPS signal.

(iv) The wet component of refraction in the troposphere contributes the larger portion of the range error.

2. *(a)* Discuss different types of levelling with the help of suitable diagram(s). 7

(b) A dumpy level is set near to station *A* and the staff readings at *A* and at the distant station *B* are 0·95 m and 2·87 m respectively. When the instrument is set near to station *B*, the staff readings are 0·46 m at *A* and 1·01 m at *B*. If *AB* is 300 m, then determine the collimation error in degrees. Also by assuming a reasonable value of radius of earth, estimate the curvature error. 7

3. *(a)* What are different types of bearing? Discuss the method of converting a whole circle bearing to reduced bearing. 7

(b) Discuss the different instruments used in plane table surveying. Also explain the method of intersection in plane table surveying. 7

4. *(a)* Explain the temporary adjustments for angle measurement using Vernier theodolite. 4

(b) What do you mean by baseline in triangulation? Explain in detail a method to set out the baseline. 6

(c) Two stations *A* and *B* at 90 km apart have elevation of 190 m and 980 m respectively. If the elevation of a peak *P* at a distance 37 km from *A* is 280 m, then using Captain McCaw's method find out whether stations *A* and *B* are inter-visible or not. 4

5. (a) Draw a neat diagram of a simple circular curve. With the help of the diagram, explain the various elements of simple circular curve. 7

(b) Two tangents intersect at the chainage of 2000 m, the deflection angle being 36°. Calculate all the data necessary for setting out a circular curve with radius of 300 m by deflection angle method. The peg interval is 30 m. 7

6. (a) Differentiate between Geodimeter and Tellurometer. What are different factors that affect the accuracy of distance measurement using EDM instruments? 7

(b) Discuss the basic components of a total station. Discuss in detail about the different applications of total station for civil engineering projects. 7

7. *(a)* What is vertical aerial photograph? With respect to a vertical aerial photograph, discuss the following using a suitable diagram : 7

(i) Principal Point

(ii) Principal Line

(iii) Isocentre

(iv) Camera Axis

(v) Nadir Point

(b) A tower was identified on a vertical photograph and the radial distance between its top and its bottom was measured to be 15 mm. The photo-coordinates of top of the displaced tower are $x_a = 45$ mm and $y_a = 72$ mm. The focal length used to take this photograph is 305 mm. If the flying height of the aircraft is 1500 m above the mean sea level (MSL) and the base of the building is 400 m above MSL, how tall is the building? 7

8. *(a)* What do you understand by GPS? How is it helpful in mapping of a region? 7

(b) What are the different methods for GPS surveying? Explain any one of them in detail. 7

9. (a) Describe various applications of remote sensing in the field of civil engineering with suitable examples. 7

(b) Discuss in brief the digital image processing process. What are the advantages of digital image processing? 7

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(iii) Error due to nonuniform graduation

(iv) Index error of vertical circle

(v) Error due to slip 6+8=14

8. (a) Define the following :

(i) Counter line

(ii) Contour interval

(iii) Horizontal equivalent

(b) What are the characteristics of contour lines?

(c) List the names of methods employed for solving three-point problem. Describe any one method in detail. 4+3+7=14

9. Write short notes on any *four* of the following : 14

(a) Tape correction

(b) Optical square

(c) Diagonal scale

(d) Dumpy level

(e) Plane-table survey

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2013

FIELD MEASUREMENT (SURVEYING)

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option of the following (any *seven*) : 2×7=14

(a) The main principle of surveying is to work

(i) from part to whole

(ii) from whole to part

(iii) from higher level to lower level

(iv) from lower level to higher level

(b) The angle of intersection of the two plane mirrors of an optical square is

(i) 30°

(ii) 45°

(iii) 60°

(iv) 90°

(Turn Over)

(c) The allowable length of an offset depends upon

(i) the degree of accuracy required

(ii) the method of setting out the perpendiculars and nature of ground

(iii) the scale of plotting

(iv) All of the above

(d) The correction for sag is

(i) always additive

(ii) always subtractive

(iii) always zero

(iv) sometimes additive and sometimes subtractive

(e) Which of the following statements is incorrect?

(i) The true meridians at different places are parallel to each other

(ii) The true meridian at any place is not variable

(iii) The true meridians converge to a point in northern and southern hemispheres

(iv) The maps prepared by national survey departments of any country are based on true meridians

(f) The most reliable method of plotting a theodolite traverse is

(i) by consecutive coordinates of each station

(ii) by independent coordinates of each station

(iii) by plotting included angles and scaling off each traverse leg

(iv) by the tangent method of plotting

(g) The prismatic compass and surveyor's compass

(i) give WCB (whole circle bearing) of a line and QB (quadrantal bearing) of a line respectively

(ii) both give QB of a line and WCB of a line

(iii) both give QB of a line

(iv) both give WCB of a line

(h) Which of the following is not the function of levelling head?

(i) To support the main part of the instrument

(ii) To attach the theodolite to the tripod

(iii) To provide a means for levelling the theodolite

(iv) None of the above

(i) The line normal to the plumb line is known as

(i) horizontal line

(ii) level line

(iii) datum line

(iv) vertical line

(j) Which one of the following is Lehmann's rule of plane tabling?

(i) The location of the instrument station is always distant from each of the three rays from the known points in proportion to their distances

(ii) When looking in the direction of each of the given points, the instrument station will be on the right side of one ray and on the left side of the other ray

(iii) When the instrument station is outside the circumscribing circle, its location is always on the opposite side of the ray to the most distant point as the intersection of the other two rays

(iv) None of the above

2. (a) Differentiate between plane surveying and geodetic surveying.

(b) What do you understand by accuracy and precision?

(c) A 30 m chain was found to be 12 cm too long after chaining a distance of 1750 m. It was found to be 23 cm too long at the end of day's work after chaining a total distance of 3600 m. Find the true distance if the chain was corrected before the commencement of the work. 4+4+6=14

3. (a) What is offset? What are the points to be considered while selecting offsets?

(b) With the neat sketches, explain any two methods of chaining along a sloping ground.

(c) In chaining a line, what is the maximum slope (i) in degrees, and (ii) as 1 in n, which can be ignored if the error from this source does not exceed 1 in 1000? 5+4+5=14

4. (a) Explain the following cases with neat sketches :

(i) Obstacles to ranging but not to chaining

(ii) Obstacles to both chaining and ranging

(b) *AB* is a chain line crossing a lake. *A* and *B* are on the opposite sides of a lake. A line *AC*, 800 m long, is ranged to the right of *AB* clear of the lake. Similarly, another line *AD*, 1000 m long, is ranged to the left of *AB* such that the points *C*, *B* and *D* are in the same line. The lengths *BC* and *BD* are 400 m and 600 m respectively. If the chainage at *A* is 1200 m, calculate the chainage of *B*.

7+7=14

5. (a) What do you understand by local attraction? What are the methods for detecting and eliminating local attraction?

(b) The following bearings are observed in running a closed traverse :

Line	FB	BB
AB	71°05′	250°20′
BC	110°20′	292°35′
CD	161°35′	341°45′
DE	220°50′	40°05′
EA	300°50′	121°10′

Determine the correct magnetic bearings of the lines. 7+7=14

6. (a) Explain how the procedure of reciprocal levelling eliminates the effect of atmospheric refraction and earth's curvature as well as the effect of inadjustment of the line of collimation.

(b) From a running fly levels from a bench mark of RL 183·215, the following readings were obtained :

BS	1·215	2·035	1·980	2·625
FS	0·965	3·830	0·980	

From the last position of the instrument, five pegs at 20 m intervals are to be set out on a uniform rising gradient of 1 in 40; the first peg is to have an RL of 181·580. Work out the staff readings required for setting the tops of the pegs on the given gradient.

7+7=14

7. (a) What are temporary adjustments of the instrument? Explain in brief. Why is it necessary?

(b) Explain how you would take field observations with a theodolite so as to eliminate the following :

(i) Error due to eccentricity of verniers

(ii) Error due to nonadjustment of line of sight

Code : 011404

B.Tech. 4th Semester Exam., 2014

FIELD MEASUREMENT (SURVEYING)

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the most correct option from the following (any *seven*) : 2×7=14

(a) The shrinkage factor of an old map is 24/25 and the RF is 1/2400. Then the corrected scale for the map is

(i) 1/2400

(ii) 1/2500

(iii) 1/600

(iv) 1/60000

(b) The smallest length that can be drawn on a map is

(i) 0·5 mm

(ii) 0·2 mm

(iii) 10 mm

(iv) 15 mm

(c) In a metric chain, the number of links per metre can be

(i) 2

(ii) 8

(iii) 5

(iv) 10

(d) Correction for slope is given by

(i) $h^2/2L$

(ii) h/L

(iii) $h/2L$

(iv) $2h^2/L$

(e) The whole circle bearing of a line whose quadrantal bearing is S 19°30′ E, is

(i) 19°30′

(ii) 199°30′

(iii) 160°30′

(iv) 340°30′

(f) Removal of parallax may be achieved by

(i) refocussing the objective

(ii) refocussing the eyepiece

(iii) refocussing the eyepiece and the objective

(iv) moving the shifting centre

(g) The coordinates of A are 100 (northing) and 200 (easting), whereas that of B are 100 (southing) and 200 (easting). The length AB is

(i) 200 m

(ii) 282·84 m

(iii) 244·94 m

(iv) 400 m

(h) Correction due to refraction is given by

(i) 0·0112 D^2

(ii) 0·0785 D^2

(iii) 0·0673 D^2

(iv) 0·0012 D^2

(i) If the focal length of an object glass is 25 cm, stadia interval is 1·25 mm and the distance from object glass to the trunnion axis is 15 cm, the additive constant is

(i) 0·1

(ii) 1·66

(iii) 20

(iv) 0·4

(j) The major source of error in small-scale mapping by plane table is due to

(i) long sight

(ii) shrinkage of drawing sheet

(iii) a few observations

(iv) inaccurate centring

2. (a) Describe briefly how plane surveying differs from geodetic surveying. 6

(b) A rectangular plot of land of area 0·45 hectare is represented on a map by a similar rectangle is of 5 cm^2. Calculate the RF of the scale of the map. Draw a scale to read up to a single metre from the map. The scale should be long enough to measure up to 400 m. 8

3. (a) Define the following terms : 6

Main stations, subsidiary stations, tie stations and base line

(b) *P* and *Q* are two points 517 m apart on the same bank of a river. The bearings of a tree on the other bank observed from *P* and *Q* are N 33°40′ E and N 43°20′ W respectively. Find the width of the river if the bearings of *PQ* are N 78° E. 8

4. The following are the bearings observed while traversing with a compass, an area where local attraction was suspected :

Line	*FB*	*BB*
AB	59°00′	239°00′
BC	139°30′	317°00′
CD	215°15′	36°30′
DE	208°00′	29°00′
EA	318°30′	138°45′

Find the correct bearings of the lines and also the true bearings if the magnetic declination is 10° W. 14

5. (a) What are the advantages and disadvantages of plane tabling? 7

(b) State and explain three-point problem in brief. 7

6. (a) What is the object of preparing a contour map? 4

(b) The following consecutive readings were taken with a level and a 4-metre levelling staff on a continuously sloping ground at common intervals of 30 m :

0·855 (on *A*), 1·545 m, 2·335, 3·115, 3·825, 0·455, 1·380, 2·055, 2·855, 3·455, 0·585, 1·015, 1·850, 2·755, 3·845 (on *B*)

The RL of *A* was 380·500. Make enteries in a level book and apply the usual checks.

Determine the gradient of *AB*. 10

7. *(a)* What is Gale's table? What are the characteristics of this table? 5

(b) An incomplete traverse table is obtained as follows : 9

Line	*Length* (m)	*Bearing*
AB	100·0	?
BC	80·5	140°30′
CD	60·0	220°30′
DA	?	310°15′

Obtain the missing length and bearing of line as indicated in the above table.

8. *(a)* What is the difference between a fixed-hair tacheometer and a subtense theodolite? 5

(b) The following are the records of a tacheometric survey :

Inst. station	*Staff station*	*Bearing*	*Vertical angle*	*Hair readings*
A	*B*	N 30°30′ E	+ 10°0′	1·250, 1·750, 2·250
B	*C*	S 40°0′ E	+ 5°0′	0·950, 1·750, 2·550
C	*D*	S 45°0′ W	+ 8°0′	1·550, 2·150, 2·750

(Continued)

Multiplying constant = 100 and additive constant = 0. The staff is held vertically.

Calculate the length and bearing of *DA*. 9

9. Write short notes on any *four* of the following : 3½×4=14

(a) Field book

(b) Offset

(c) Local attraction

(d) Fly levelling

(e) Benchmark

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Code : 011404

B.Tech 4th Semester Exam., 2015

FIELD MEASUREMENT

(Surveying)

Time : 3 hours | *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* of the following questions : 2×7=14

(a) What is the main principle of surveying?

(b) What do you mean by RF?

(c) What is the difference between plain scale and diagonal scale?

(d) What do you mean by triangulation?

(e) Why does the field book open lengthwise?

(f) What do you mean by azimuth?

(g) What do you mean by GTS?

(h) What are the different types of BM that you know?

(i) What is the relation between line of collimation and axis of telescope?

(j) What is a transit theodolite?

2. (a) The record of a closed traverse is given below, with two distances missing :

Line	*Length* (m)	*Bearing*
AB	100·5	N 30° 30′ E
BC	?	S 45° 0′ E
CD	75·0	S 40° 30′ W
DE	50·5	S 60° 0′ W
EA	?	N 40° 15′ W

Calculate the lengths of *BC* and *EA*. 7

(b) Explain closing error and its limitations. 7

3. (a) The following observations were made during the testing of a dumpy level :

Instrument at	*Staff reading*	
	A	*B*
A	1·725	2·245
B	2·145	3·045

Distance between *A* and *B* = 200 m

RL of *A* = 450·000 m

(i) Is the instrument in adjustment?

(Continued)

(ii) What should be the staff reading on *A* during the second setup of the instrument for the line of collimation to be exactly horizontal?

(iii) What should be the RL of *B*? 7

(b) Explain the sources of errors in levelling. 7

4. (a) The following records refer to an operation in colouring reciprocal levelling :

Instrument at	*Staff readings on*		*Remarks*
	A	*B*	
A	1·155	2·595	Distance *AB* = 500 m
B	0·985	2·415	RL of *A* = 525·500 m

Find—

(i) the true RL of *B*;

(ii) the combined correction for curvature and refraction;

(iii) the collimation error;

(iv) whether the line of collimation is inclined upwards or downwards. 7

(b) What are the different types of level? Explain. 7

(Turn Over)

5. *(a)* Explain the sources of errors in compass. 7

(b) The following are the observed bearings of the lines of a traverse *ABCDEA* with a compass in a place where local attraction was suspected :

Line	*FB*	*BB*
AB	191° 45′	13°
BC	39° 30′	222° 30′
CD	22° 15′	200° 30′
DE	242° 45′	62° 45′
EA	330° 15′	147° 45′

Find the correct bearings of the lines. 7

6. *(a)* What is local attraction? What are the methods of application of correction? 7

(b) A traverse *ABCDA* is made in the form of a square taking in clockwise order. If the bearing of *AB* is 120°30′, find the bearing of the order sides. 7

7. *(a)* What do you understand by field book? How many types of field book are used? Explain. 7

(b) An offset was laid out 5° from its true direction and the scale of map was 20 m to 1 cm. Find the maximum length of offset for the displacement of a point on a paper not to exceed 0·03 cm. 7

8. *(a)* A plan represents an area of 93750 m^2 and measures 6·00 cm × 6·25 cm. Find the scale of the plot and indicate through a sketch how suitable scale can be constructed to read up to 1 m in the plan. 7

(b) A line was measured by a 20 m chain which was accurate before starting the day's work. After chaining 900 m, the chain was found to be 6 cm too long. After chaining a total distance of 1575 m, the chain was found to be 14 cm too long. Find the true distance of the line. 7

9. *(a)* Explain the various tape corrections used in chaining/tape. 7

(b) An old map was plotted to a scale of 40 cm to 1 cm. Over the years, this map has been shrinking, and the line originally 20 cm long is only 19·5 cm long at present. Again the 20 cm chain was 5 cm too long. If the present area of the map measured by planimeter is 125·50 cm^2, find the true area of the land surveyed. 7

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Code : 011404

B.Tech 4th Semester Exam., 2016

FIELD MEASUREMENT (SURVEYING)

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* of the following questions : 14

   (a) What is the main principle of surveying?

   (b) What is the fundamental difference between surveying and leveling?

   (c) What is reconnaissance survey?

   (d) In a chaining operation, who is the leader and who is the follower?

   (e) What is change point?

   (f) What is transiting?

(g) What is baseline of survey?

(h) What is tacheometry?

(i) What is the principle of tacheometry?

2. (a) Construct a diagonal scale representing 1 cm = 2·5 m and show a distance of 42·7 m on it. 6

(b) A 20 m steel tape was standardized on flat ground at a temperature of 20 °C and under a pull of 15 kg. The tape was used in catenary at a temperature of 30 °C and under a pull of P kg. The cross-sectional area of the tape is 0·22 cm^2 and its total weight is 400 g. The Young's modulus and coefficient of linear expansion of steel are $2{\cdot}1\times10^6$ kg/cm^2 and 11×10^{-6} per °C respectively. Find the correct horizontal distance, if P is equal to 10 kg. 8

3. (a) Describe briefly how plane surveying differs from geodetic surveying. 6

(b) A chain line ABC crosses a river, B and C being on the near and distant banks respectively. A line BD of length 60 m is set out at right angles to the chain line at B. If the bearings at D to the stations C and B were 65°30′ and 110°30′ respectively, find the width of the river. 8

4. (a) Define the following : 5

(i) Whole-circle bearing and reduced bearing

(ii) True meridian and magnetic meridian

(b) The bearings of the sides of a traverse $ABCDE$ are as follows :

Side	Fore bearing	Back bearing
AB	12°00′	192°00′
BC	271°30′	91°30′
CD	189°15′	9°15′
DE	124°45′	304°45′
EA	97°15′	277°15′

Calculate the interior angles of the traverse and check it. 9

5. (a) What is the principle of plane table survey? Name the different instruments and accessories used in it. 7

(b) What is a two-point problem? Explain with a neat sketch the procedure of solving a two-point problem in plane table surveying. 7

6. (a) Name the different types of levelling operations and explain any one. 5

(b) The following readings are successively taken with a level :

0·255, 0·457, 0·760, 1·750, 1·985, 2·530, 1·980, 0·845, 0·680 and 2·535

The position of the instrument was changed after the third and eighth readings. Prepare a level book and calculate the RLs of different points. The RL of first point is 105·750. Apply the usual checks. 9

7. (a) Define the terms 'contour line', 'contour interval' and 'horizontal equivalent'. 6

(b) While measuring a chain line *AB*, the following offsets are taken :

(i) A telegraph post is 10 m perpendicularly from 2·5 m chainage to the right of the chain line

(ii) A road crosses obliquely from left to right at 10 m and 14 m chainage. Perpendicular offsets are 2 m and 3 m to the side of the road from 5 m and 20 m chainage respectively

(iii) A tube well is 5 m perpendicularly from 30 m chainage to the left of the chain line

(iv) Total chainage of *AB* is 45 m

How would you enter the field book? 8

8. (a) What is the temporary adjustment of a theodolite? Describe the process of such adjustment. 6

(b) A tacheometer was set up at a station *P* and the following readings were obtained on a staff vertically held :

Inst. station	*Staff station*	*Vertical angle*	*Hair readings*	*Remarks*
P	*BM*	− 4° 20′	1·40, 1·60, 2·35	*RL* of *BM* = 720·50 m
P	*Q*	+ 7° 12′	0·65, 1·40, 2·15	

Calculate the horizontal distance *PQ* and *RL* of *Q*, when the constants of instrument are 100 and 0·15. 8

9. Write short notes on any *three* of the following : 14

(a) Leveling staff

(b) Optical square

(c) EDM

(d) Dumpy level

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Code : 011404

B.Tech 4th Semester Examination, 2017

Field Measurement

Time : 3 hours *Full Marks : 70*

Instructions :

*(i) There are **Nine** Questions in this Paper.*

*(ii) Attempt **Five** questions in all.*

*(iii) **Question No. 1 is Compulsory.***

(iv) The marks are indicated in the right-hand margin.

1. Answer any seven of the following questions: 14

(i) The object of surveying is to prepare

(a) drawing

(b) cross-section

(c) map

(ii) The diagonal scale is used to read

(a) one unit

(b) two units

(c) three consecutive units

(iii) Compensating error is proportional to

(a) L

(b) sqrt of L

(c) L^2

(iv) A triangle is said to be well-conditioned when its angles should lie between

(a) 30^o

(b) 20^o and 150^o

(c) 15^o and 135^o

(v) In an optical square, the mirrors are fixed at an angle of

(a) 30^o

(b) 45^o

(c) 60^o

(vi) The main object of running a tie line is

(a) to check accuracy of work

(b) to take details of a nearby objects

(c) to take an offset for detailed surveying

(d) none of the above

(vii) In a prismatic compass, the zero is marked on the

(a) north end

(b) south end

(c) west end

(viii) The BM fixed at the end of a day's work is called the

(a) permanent BM

(b) arbitrary BM

(c) temporary BM

(ix) When contours of different elevation cross each other, it indicates a/an

(a) vertical cliff

(b) saddle

(c) overhanging cliff

(x) In tangential tachometry the staff is held

(a) inclined

(b) normal to the line of sight

(c) vertically

2. (a) Discuss the different errors in chaining. 6

(b) A 30 m steel type was standardized at a temperature of 20°C and under a pull of 5 kg. the tape was used in catenary at a temperature of 25°C and under a pull of P kg. The cross-sectional area of the tape is 0.02 cm^2, and

its weight per unit length is 22 g/m, Young's modulus = 2 X 10^6 kg/cm^2, $\alpha = 11 \times 10^{-6}$ per °C. Find the correct horizontal distance if P is equal to (a) 5 kg and (b) 11 kg. 8

3. (a) What are well-conditioned and ill-conditioned triangles? 6

(b) A rectangular plot of land of 0.45 hectare area is represented on a map by a similar rectangular area of 5 cm^2. Calculate the RF of the scale of the map. Draw a scale to read up to a single metre from the map. The scale should be long enough to measure up to 400 m (1 hectare = 10,000 m^2) 8

4. (a) What is local attraction ? How is it detected and adjusted? 6

(b) The table below shows readings in a compass survey. Find the local attraction, if any, at any station and also find the corrected bearing. 8

Line	FB	BB
AB	N 76° 00' E	S 76° 00' W
BC	N 47° 00' E	S 40° 00' W
CD	S 17° 00' E	N 10° 00' W
DE	N 32° 00' E	S 32° 00' W

5. (a) State the advantages and disadvantages of plane table survey over other types of survey. 7

(b) Describe the procedure of setting up the plane table over a station. 7

6. (a) When is reciprocal levelling done? Describe the method along with a sketch. 6

(b) The following set of observations were taken to reach a given point. Form this point onwards a rising gradient of 1 in 15 starts. Calculate the required staff reading for the remaining four points. These points were spaced at an equal distance of 10 m each. 8

SI No.	BS	IS	FS	RL	Remarks
				270.500	BM
1.	3.250				
2.	2.300		2.800		CP
3.		1.830			
4.		1.500			
5.	3.795		1.050		CP and given point slope starts,
6.		-			1st pt
					2nd point
7		-			3rd point
8.		-	-		4th point
9.		-			P.T.O.

7. (a) What are the characteristics of contour lines? 6

(b) The following offsets were taken at 15 m intervals from a survey line to an irregular boundary line: 3.50, 4.30, 6.75, 5.25, 7.50, 8.80, 7,90, 6.40, 4.40, 3.25 m. Calculate the area enclosed between the survey line, the irregular boundary, and the first and last offsets, by using Simpson's rule. 8

8. (a) Describe the method of determining the constants of a tachometer from field measurement. 6

(b) In a tachometric survey the instrument had a multiplying constant of 100 and was fitted with an anallatic lens. The staff was held normal to the line of sight and the following observations were taken:

Instrument Station	Height of axis	Staff at	Vertical angle	Staff readings
O	1.6 m	BM	–3° O'	1.400, 2.140, 2.880
O	1.6 m	CP	+5° 20'	1.205, 1.795, 2.385
A	1.4 m	CP	–5° 30'	1.395, 2.010, 2.625

If the RL of the BM is 192.105m, calculate te RL of the station A. 8

9. Write Short notes on any three: 14

(i) Ranging

(ii) Surveyor's Compass

(iii) Orientation

(iv) Tachometry

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Code : 011404

B.Tech 4th Semester Exam., 2018

FIELD MEASUREMENT

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **EIGHT** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) Tilt of the staff in stadia tacheometry increases the intercept, if it is

(i) away from the telescope pointing downhill

(ii) towards the telescope pointing uphill

(iii) away from the telescope pointing uphill

(iv) None of the above

(b) Chain surveying is well adopted for

(i) small areas in open ground

(ii) small areas with crowded details

(iii) large areas with simple details

(iv) large areas with difficult details

(c) Surveys which are carried out to depict mountains, rivers, water bodies, wooded areas and other cultural details, are known as

(i) cadastral surveys

(ii) city surveys

(iii) topographical surveys

(iv) guide map surveys

(d) The number of horizontal cross-wires in a stadia diaphragm is

(i) one

(ii) two

(iii) three

(iv) four

(e) Under ordinary conditions, the precision of a theodolite traverse is affected by

(i) systematic angular errors

(ii) accidental linear errors

(iii) systematic linear errors

(iv) accidental angular errors

(f) Setting out a curve by two-theodolite method involves

(i) linear measurements only

(ii) angular measurements only

(iii) both linear and angular measurements

(iv) None of the above

(g) If the chain line which runs along N-S direction is horizontal and the ground in E-W direction is sloping

(i) it is possible to set offsets correctly on East side

(ii) it is possible to set offsets correctly on West side

(iii) it is not possible to set offsets correctly on West side

(iv) it is possible to set offsets correctly on both sides

(h) With the rise of temperature, the sensitivity of a bubble tube

(i) decreases

(ii) increases

(iii) remains unaffected

(iv) None of the above

(i) During levelling, if back sight is more than foresight

(i) the forward staff is at lower point

(ii) the back staff is at lower point

(iii) the difference in level, cannot be ascertained

(iv) None of the above

(j) Closed contours, with higher value inwards, represent a

(i) depression

(ii) hillock

(iii) plain surface

(iv) None of the above

2. (a) Derive an expression for computing horizontal distance and elevation in trigonometric levelling while base of the object is inaccessible and instrument stations are in the same vertical plane with elevated object and instrument axis are at same level. 7

(b) Describe various accessories required for plane table survey with neat sketch and also write their uses. 7

3. (a) Two tangent intersect at a chainage of 1320·5 m. The deflection angle being 24°. Calculate the following quantities for setting out a simple circular curve of radius 275 m : 7

(i) Tangent length

(ii) Length of long chord

(iii) Length of curve

(iv) Chainage of point of commencement and tangency

(v) Apex distance

(vi) Versed sine of curve

(b) Explain the temporary adjustment of theodolite and also write uses of theodolite. 7

4. (a) Write short notes on the following : 7

(i) Transition curve

(ii) Vertical curves

(b) Explain the various objectives of hydrographic survey. Also, enlist equipment used for sounding and explain any one in brief. 7

5. (a) The areas enclosed by the contour of a lake are as under :

Contour level (m)	270	275	280	285	290
Area (in sq. m)	2050	8400	16300	24600	31500

Calculate the volume of water stored between contour 270 m and 290 m by *(i)* trapezoidal formula and *(ii)* prismoidal formula. 7

(b) What is sounding? State the different methods of locating sounding and explain any one method. 7

6. (a) Enlist different methods of plane tabling and explain method of traversing. 7

(b) Explain the procedure for evaluating missing quantities in a closed traverse. 7

7. (a) Define trigonometric levelling. Derive the equation to find out the elevation of the object, if the base of the object is inaccessible, the instruments, stations and elevated object are in the same vertical plane and instrument axes are at the same level. 7

(b) What are the general methods of calculating area? Explain double meridian distance (DMD) method in detail. 7

8. *(a)* Define *(i)* swinging, *(ii)* line of collimation, *(iii)* temporary adjustment of theodolite, *(iv)* plunging, *(v)* telescope normal, *(vi)* centering and *(vii)* vertical axis. 7

(b) Illustrate with an example in a tabular format about repetition method of measurement of horizontal angle with the help of a theodolite. 7

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B.Tech. 5th Semester Exam., 2013

ADVANCED SURVEYING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option (any *seven*) :

(a) The best method of laying a curve is by

(i) tacheometer

(ii) two theodolites

(iii) deflection distances

(iv) offsets from the tangents produced

(b) A parabola is best suited for a vertical curve since

(i) it provides a longer sight distance

(ii) rate of change of grade is uniform throughout

(iii) smooth riding condition is provided

(iv) All of the above

(c) Shift of a curve is

(i) $\frac{L^2}{6R}$

(ii) $\frac{L}{24R}$

(iii) $\frac{L^2}{24R}$

(iv) $\frac{L}{6R}$

(d) An ideal transition curve is

(i) cubic parabola

(ii) cubic spiral

(iii) parabola

(iv) true spiral

(e) The process of determining the elevations of stations from vertical angles and geodetic lengths at mean sea level is known as

(i) levelling

(ii) trigonometric levelling

(iii) triangulation

(iv) hypsometry

(f) The best shape of a triangle in triangulation is

(i) equilateral

(ii) isosceles with base angle 56° 14'

(iii) isosceles with base angle 65° 14'

(iv) isosceles with base angle 60°

(g) Tellurometer is an instrument used for

(i) GPS

(ii) EMR

(iii) GTS

(iv) EDM

(h) The weight of an angle α is 2. The weight of 2α will be

(i) $\frac{2}{2}$

(ii) $\frac{2^2}{2}$

(iii) $\frac{2}{\sqrt{2}}$

(iv) $\frac{2}{2^2}$

(i) The unit of sounding is

(i) m/s

(ii) cm^2 /s

(iii) fathom

(iv) cycles/sec

(j) A star culminates in zenith when

(i) $\delta < \theta$

(ii) $\delta > \theta$

(iii) $\delta \leq \theta$

(iv) $\delta = \theta$

2. (a) What is shift? Prove that a transition curve bisects a shift and that a shift bisects a transition curve.

(b) The alignment of a road is as follows :

Line	*WCB*	*Length* (m)
AB	30° 0′	250
BC	90° 0′	150
CD	140° 0′	325

These three lines are to be connected by a single-circular curve. Find the radius and tangent length.

3. In a road alignment, a grade of –1·0% is followed one of +0·5%. The chainage and RL of the intersection point are 400 m and 250 m respectively. The rate of change of grade is 0·1% per 20 m. Calculate the necessary data for setting out the vertical curve, taking a peg interval of 30 m.

4. The following mean values of the three angles of a triangle were observed :

$\angle A = 54°12'25''$ Weight = 8

$\angle B = 48°46'16 \cdot 25''$ Weight = 4

$\angle C = 77° 02'10 \cdot 83''$ Weight = 6

Determine the corrected values of the angles by the method of least squares.

5. *(a)* List the major components of electromagnetic spectrum and the use of each type of radiation.

   (b) What are the applications of electronic distance measurement? What are the main classes of EDM instruments?

6. *(a)* Explain briefly the various types of signals giving their merits and demerits.

   (b) A base line was measured in four catenary lengths of 30·126 m, 29·98 m, 30·06 m and 24·56 m. The difference of levels was respectively 0·45 m, 0·55 m, 0·40 m and 0·5 m. The temperature during observation was 12 °C and the straining mass was 15 kg. The tape was standardized as 30 m at 22 °C with a straining mass of 5 kg. The coefficient of expansion was 0·000011/°C, the mass of tape =1kg, cross-sectional area=3 mm^2, $E = 210 \times 10^3\ N/mm^2$ and $g = 9 \cdot 81\ m/s^2$. Calculate the length of the base.

7. *(a)* Define sounding and state the equipment and personal used for locating and making soundings. What is meant by reduction of sounding?

   (b) From the boat *O* offshore readings were taken to three shore signals *A*, *B* and *C* with the help of sexant. The angles *AOB* and *BOC* were 32°30′ and 62°30′ respectively. The distances *AB* and *BC* were measured to be 360 m and 615 m respectively and the angle *ABC* on the landward side was 233°30′. Determine the distance of the boat from the signal *B*.

8. *(a)* What do you understand by the following?

   Aphetion, Equinox, Solstice, Ecliptic, Sidereal time

   (b) The attitude of a star at the upper culmination is 72° 30′ and that at the lower culmination is 20°30′, both the culminations being to the north side of the zenith of the place. Determine the declination and the latitude of the observer.

9. It is required to determine the elevation of a station *O*. Observations were made to three stations *A*, *B* and *C* already fixed and of known elevations. The following data was recorded :

Instrument station	*Station observed*	*Height of instrument* (m)	*Distance* (m)
O	*A*		3600
	B	1·50	4700
	C		5000

	Height of signal (m)	*Vertical angle*
	5·6	1°1′20″
	4·1	–53′00″
	4·9	–34′10″

The reduced level of *A*, *B* and *C* were 294 m, 159·5 m and 181 m respectively. Take m = 0·07 and RS in 1″ = 30·88 m.

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Code : 011508

B.Tech 5th Semester Exam., 2014

ADVANCED SURVEYING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option (any *seven*) :

(a) Different grades are joined together by a

(i) compound curve

(ii) transition curve

(iii) reverse curve

(iv) vertical curve

(b) If the angle of intersection of a curve is θ, then the deflection angle will be

(i) $\theta/2$

(ii) $180°-\theta$

(iii) $180°+\theta$

(iv) $90°+\theta$

(c) Total angle of deflection of a transition curve is

(i) spiral angle

(ii) spiral angle/2

(iii) spiral angle/3

(iv) spiral angle/4

(d) A broken-back curve is a type of

(i) horizontal curve

(ii) vertical curve

(iii) transition curve

(iv) reverse curve

(e) Which one is a correction to be applied in trigonometric levelling?

(i) Correction for dip

(ii) Correction for semidiameter of Sun

(iii) Axis signal correction

(iv) Parallax correction

(f) Mekometer has a range of

(i) 1 km

(ii) 3 km

(iii) 10 km

(iv) 50 km

(g) The towers used in triangulation are known as

(i) heliotropes

(ii) Bilby

(iii) Captain McCaw

(iv) Hunter

(h) Spherical excess in seconds is given by

(i) $\frac{A}{R^2} \times 206265$

(ii) $\frac{A}{R^2} \times \frac{1}{206265}$

(iii) $\frac{A}{R} \times 206265$

(iv) $\frac{A^2}{R} \times 206265$

(i) The major tide producing force is due to

(i) Sun

(ii) Mass

(iii) Venus

(iv) Moon

(j) For a celestial body, in astronomy, which is a function of line?

(i) Azimuth

(ii) Altitude

(iii) Hour angle

(iv) All of the above

2. (a) What are the different types of curve? Draw neat sketches of each.

(b) Two parallel lines 200 m apart are to be joined by a reverse curve with a deflection angle of 30°. If the radius of the first arc is 400 m and the chainage of the starting point of the curve 1500 m, calculate the radius of the second arc, the chainage of the point of reverse curvature and the finishing point of the reverse curve.

3. (a) Derive an expression for an ideal transition curve.

(b) Two straight lines AB and BC intersect at B, the chainage of B being 1500 m. Another line EF intersects AB and BC such that $\angle BEF = 30°30'$ and $\angle BFE = 40°30'$. The length EF is 175 m. Find the radius of the curve which will be tangential to AB, EF and BC. Also calculate the chainages of the tangent points.

4. Find the most probable values of the angles α, β and γ from the following observations at one station :

$\alpha = 38°12'26 \cdot 5''$	Weight = 1
$\beta = 32°45'13 \cdot 2''$	Weight = 2
$\alpha + \beta = 70°57'38 \cdot 6''$	Weight = 2
$\alpha + \beta + \gamma = 126°28'0 \cdot 6'$	Weight = 3
$\beta + \gamma = 88°15'37 \cdot 8''$	Weight = 1

5. *(a)* What are the corrections to be applied to the observed altitude of Sun?

(b) Calculate the azimuth of a star of declination 72°17'12" N at eastern elongation in latitude 43°53'53" N.

6. *(a)* Define the following :

(i) Strength of figure

(ii) Heliotropes

(iii) Spherical excess

(iv) Distance angles

(b) The elevations of points *A*, *B* and *C* are 100 m, 110 m and 125 m, respectively. The distance *AB* is 6 km and that of *BC* is 8 km. Will *B* create an obstruction to the line of sight from *A* to *C*? What will be the height of the signal required?

  Turn Over)

7. Determine the coordinates of the position of a ship *O*, an observer in the ship measured the angles of the stations *A*, *B* and *C* located on the sea shore—$\angle AOB = 62°20'00''$ and $\angle BOC = 40°30'00''$. The ship was south of the stations at the time of observation. The coordinates of the stations *A*, *B* and *C* were as follows :

Station	*Latitude*	*Departure*
A	0	0
B	500 N	1000 E
C	300 N	1500 E

8. Two stations *A* and *B* were at a distance 1800·50 m apart. Reciprocal observations were made to determine the difference of level between them. The following data was recorded :

Height of instrument at *A* = 1·463 m
Height of instrument at *B* = 1·457 m
Height of signal at *A* = 1·647 m
Height of signal at *B* = 1·762 m
Vertical angle from *A* to *B* = + 1°42'2"
Vertical angle from *B* to *A* = − 1°41'46"

Calculate also the height of *B* above *A*, using the vertical angle from *A* only. Assume the coefficient of refraction as 0·07.

9. *(a)* Explain the basic principle of EDM.

(b) Explain the functioning of a geodimeter and a distomat.

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 Code : 011508

(b) Explain the following terms :

(i) Independent quantity

(ii) Direct observation

(iii) Indirect observation

(iv) Weight of an observation

8. What is the three-point problem in hydrographic surveying? What is the main purpose for which it is carried out? Show with the help of neat sketches how it is solved, mechanically and graphically.

9. Determine the coordinates of the position of a ship *Z*, an observer in the ship measured the angles of the stations *A*, *B* and *C* located on the seashore. Angle $AOB = 62°20'00''$ and angle $BOC = 40°30'00''$. The ship was south of the station at time of observation. The coordinates of the stations *A*, *B* and *C* were as follows :

Station	Latitude	Departure
A	0	0
B	500 N	1000 E
C	300 N	1500 E

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B.Tech 5th Semester Exam., 2015

ADVANCE SURVEYING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) ***All*** *questions carry equal marks.*

(ii) *There are* ***NINE*** *questions in this paper.*

(iii) *Attempt* ***FIVE*** *questions in all.*

(iv) *Question No.* ***1*** *is compulsory.*

1. Choose the correct answer of the following (any *seven*) :

(a) The relief displacement of a minar 72 m high on photograph is 7·2 mm and its top appears 10 cm away from principal point. The flying height of the camera is

(i) 2000 ft

(ii) 1500 ft

(iii) 500 ft

(iv) 1000 ft

(b) While making astronomical observations, the observer is mainly concerned with

(i) the direction of the vertical, the axis of rotation of the instrument

(ii) the direction of the star from the instrument

(iii) the direction of the poles of the celestial sphere

(iv) All of the above

(c) The most convenient coordinate system for specifying the relative positions of heavenly bodies on the celestial sphere is

(i) declination and hour angle system

(ii) declination and altitude system

(iii) altitude and azimuth system

(iv) declination and right ascension system

(d) Perspective centre relates to

(i) orthogonal projection

(ii) parallel projection

(iii) central projection

(iv) None of the above

(e) The point where vertical line passing through the perspective centre intersects the plane of the photograph, is known as

(i) plumb point

(ii) photo plumb point

(iii) nadir point

(iv) isocentre

(f) The principal plane contains

(i) principal point

(ii) principal axis and principal line

(iii) isocentre

(iv) All of the above

(g) Triangulation surveys are carried out for locating

(i) control points for surveys of large areas

(ii) control points for photogrammetric surveys

(iii) engineering works, i.e., terminal points of long tunnels, bridge abutments, etc.

(iv) All of the above

(h) The circle in which a plane tangent to the earth's surface at the point of observation, intersects the celestial sphere, is called

(i) true horizon

(ii) visible horizon

(iii) sensible horizon

(iv) celestial horizon

(i) In field astronomy, the quantities observed are entirely

(i) angles

(ii) lengths

(iii) heights

(iv) All of the above

(j) The angle between the axis of earth and the vertical at the station of observation is called

(i) declination of star

(ii) astronomical latitude

(iii) astronomical colatitude

(iv) codeclination of star

2. Briefly explain the classification of circular curve. Write the name of the various parts of a curve with diagram. (5)

3. A simple circular curve is to have a radius of 573 m. The tangent intersects at chainage 1060 m and the angle of intersection is 120°. Find *(a)* tangent distance, *(b)* chainage at beginning and end of the curve, *(c)* length of long chord and *(d)* degree of the curve.

4. The angles of a triangle *ABC* were recorded as follows :

$A = 70°14'20''$ weight 4
$B = 49°40'35''$ weight 3
$C = 53°04'52''$ weight 2

Give the correct value of the angle. (5)

5. Explain the procedure of measurement of horizontal distance by electronic distacometer (EDM). State the four uses of total station. (5)

6. The altitudes of two proposed stations *A* and *B* are 100 km apart are respectively 400 m and 700 m. The intervening obstruction situated at *C*, 70 km apart from *A* has an elevation of 478 m. Ascertain, if *A* and *B* are intervisible, and if necessary, find by how much *B* should be rise so that line of sight must nowhere be less tan 3 m above the surface of ground.

7. *(a)* What do you mean by a weight of an observation? State the rule of assigning weight to the field observation.

Code : 011508

B.Tech 5th Semester Examination, 2016

Advanced Surveying

Time : 3 hours *Full Marks : 70*

Instructions :

(i) There are Nine Questions in this paper.

(ii) Attempt Five questions in all.

(iii) Question No. 1 is compulsory.

(iv) The marks are indicated in the right-hand margin.

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1. Choose the correct answers of the following (any seven): 2×7=14

(i) The shortest distance between two places measured along the surface of the earth, is:

(a) length of the parallel between their longitudes

(b) length of the equator between their longitudes

(c) length of the arc of the great circle passing through them

(d) none of the these

(ii) The point on the celestial sphere vertically below the observer's position, is called:

(a) celestial point

(b) nadir

(c) zenith

(d) pole

(iii) The station which is selected close to the main triangulation station, to avoid intervening obstruction, is not known as:

(a) eccentric station

(b) pivot station

(c) satellite station

(d) false station

(iv) Systematic errors:

(a) can be removed by applying corrections to the observed values

(b) either make the result too great or too small

(c) are also known as cumulative errors

(d) all of the above

(v) The necessary geometrical condition for triangulation adjustment, is :

(a) The sum of the eight angles of a braced quadrilateral should be 360°

(b) The sum of the angles around a station should be 360°

(c) The sum of the three angles of a plane triangle should be 180°

(d) All of the above

(vi) The equation which is obtained by multiplying each equation by the coefficient of its un-knowns and by adding the equations thus formed, is known as:

(a) Observation equation

(b) conditional equation

(c) normal equation

(d) none of these

(vii) Pick up the correct statement from the following:

(a) Refraction correction is zero when the celestial body is in the zenith

(b) Refraction correction is 33' when the celestial body is on the horizon

(c) Refraction correction of celestial bodies depends upon their altitudes

(d) All of the above

(vii) The radius of curvature of the arc of the bubble tube is generally kept:

(a) 10 m

(b) 25 m

(c) 50 m

(d) 100 m

(viii) The law of weight applicable to the Method of Least squares error, is:

(a) The weight of the arithmetic mean of a number of observations of unit weight, is equal to the number of observations

(b) The weight of the sum of the quantities added algebraically is equal to the reciprocal of the sum of the reciprocals of the individual weights

(c) The weight of the weighted arithmetic mean of a number of observations, is equal to the sum of the individual weights of observations

(d) The weight of the product of any quantity multiplied by a constant is equal to the weight of that quantity divided by the square of that constant.

(ix) The difference of level between a point below the plane of sight and one above, is the sum of two staff readings and an error would be produced equal to:

(a) twice the distance between the zero of graduation and the foot of the staff

(b) the distance between the zero of gradient and the foot of the staff

(c) thrice the distance between the zero of graduation and the foot of the staff

(d) none of the above

2. What is a transition curve? Explain the methods used for determining the length of a transition curve? Where are reverse curve provided? Explain the function of a transition curve? 7

3. Two straight AI and BI meet at a chainage of 3450 m. A right handed simple circular curve of 250 m radius joins them. The deflection angle between the two straights is 50°. Tabulate the necessary data to layout the curve by Rankine's method of deflection angles. Take the chord interval as 20 m.

4. Explain briefly the principle underlying "electronic distance measurement". Write a short note on the errors in EDM. What do you mean by infra-red and microwave EDM instruments? Explain Total station and its importance in surveying.

5. What is the different triangulation systems used in a geodetic survey? Enumerate the principles of least squares as applied to observation of equal weight and to those for which different weights are assigned? Why least squares is generally preferred over other adjustment technique ?

6. The elevations of two proposed triangulation station A and B, 100 km apart, are 140 m and 416 m above mean sea level, respectively. The elevation of an intervening peak at C, 60 km from A, which is likely to obstruct the line of sight, is 150 m. Ascertain if A and B are inter visible, and if not, find the height required for the scaffold at B so that the line of sight clears C by 3 m.

7. Define the following astronomical terms along with diagram (i) Zenith; (ii) Poles; (iii) Celestial Horizon; (iv) Celestial equator; (v) Ecliptic plane; (vi) Observers meridian; (vii) Declination circle; (viii) Equinoctial Colure; (ix) Right Ascension; (x) Hour Angle; (xi) Azimuth; (xii) Altitude.

8. Describe briefly the effect of curvature and refraction in levelling. Derive an expression for curvature corrections and for combined curvature and refraction correction.

9. What are sounding? Write down the equipment and personnel required to locate sounding. Describe with the help of a sketch the principle of echo-sounding.

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Code : 011508

B.Tech 5th Semester Exam., 2017

ADVANCED SURVEYING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) Setting out a simple curve by the two-theodolite method does not require

(i) angular measurements

(ii) linear measurements

(iii) both angular and linear measurements

(iv) None of the above

(b) Overturning of vehicle on a curve can be avoided by using a

(i) compound curve

(ii) vertical curve

(iii) reverse curve

(iv) transition curve

(c) Shift of curve is

(i) $L^2/6R$

(ii) $L^2/14R$

(iii) $L^2/24R$

(iv) $L/24R$

(d) The pattern wavelength employed by various EDM instruments is maximum for

(i) Tellurometer

(ii) Geodimeter

(iii) Distomat

(iv) Makenometer

(e) Zero correction in EDM instruments corresponds to the

(i) difference of final and initial readings

(ii) delay of EDM signal

(iii) difference of distance travelled by electromagnetic waves and the direct distance between the point of arrival of signal and centering mark

(iv) calibration error

(f) In triangulation survey, the indivisibility of stations can be checked by

(i) method of least squares

(ii) heliotropes

(iii) Captain G. T. McCaw's solution

(iv) three-point problem

(g) For the star to the west of meridian, the local sidereal time is given by

(i) LST = RA + HA

(ii) LST = RA – HA

(iii) LST = RA ± HA

(iv) LST = RA + declination

(h) If S is the sum of three angles of a spherical triangle, then the spherical excess equals

(i) S-90°

(ii) S-180°

(iii) S-270°

(iv) S-360°

(i) The purpose of making hydrographic survey is

(i) to determine the quantities of subaqueous excavations

(ii) to measure areas subjected to scouring and silting in harbours

(iii) to measure soundings and preparing navigation charts

(iv) All of the above

(j) Log sine correction is made in triangulation to satisfy

(i) apex condition

(ii) opposite angles

(iii) side condition

(iv) peripheral sum

2. (a) Explain briefly the principle underlying electronic distance measurement. 7

(b) How can ambiguity in phase delay be eliminated? 7

3. (a) What are the practical uses of astronomical surveying? 6

(b) A star was observed for time by equal altitude when it was on the prime vertical at a place in latitude 34°30′N. The declination of the star was +20°30′ and its right ascension 16 h 51 m 52 s. Determine the altitude when on the prime vertical and the LST of prime vertical transit. 8

4. (a) What is the three-point problem in hydrographic surveying? Show with the help of neat sketches, how it is solved mechanically. 7

(b) Calculate the discharge of a stream given the following current-meter data : 7

Distance across from one bank (m)	0	10	20	30	40	50	60	70
Depth of bed (m)	0	0·50	1	1·50	2	1·50	1	0
Velocity of flow at 0·6 m depth (m/s)	0	0·20	0·25	0·30	0·33	0·30	0·20	0

5. (a) Explain the term axis-signal correction as used in trigonometrical levelling. 5

(b) Find the reduced level of station S from the following observations. The horizontal distance from R to S is 8888 m, the angle of elevation from R to S is 2°5′20″, the height of signal at S is 3·88 m, the height of the instrument at R is 1·31 m, the coefficient of refraction is 0·07, RS in 1″ = 30·8 m, where R is earth's mean radius and RL of R is 415·500 m. 9

6. The following observations of three angles A, B and C were taken at a triangulation station :

Observations	Weights
A = 72°12′42·5″	3
B = 53°18′53·6″	4
C = 110°24′48·5″	2
$A + B$ = 125°31′36·8″	2
$B + C$ = 163°43′44·6″	2
$A + B + C$ = 235°56′26·2″	1

Determine the most probable values of the angles. 14

7. (a) Briefly explain the terms of the following : 6

(i) Satellite station

(ii) The phase of a signal

(iii) Heliotrope

(b) During the reconnaissance of a hilly part of the country for geodetic surveying, the following information was obtained regarding the profile of intervening ground between stations P and Q, the distance PQ being 120 km. The elevations above mean sea level are P = 210 m, Q = 1050 m, L = 330 m and M = 557 m. Peaks L and M are situated in the line PQ such that PL = 50 km and PM = 80 km. Determine whether P and Q are intervisible and if necessary, find the minimum height of the scaffolding at Q, assuming P as the ground station. The line of sights is to clear the peaks by at least 3 m. 8

8. (a) Deduce the relationship between the degree and radius of a curve. 5

(b) A highway curve which deflects through 80° is to be designated for a maximum speed of 100 kmph, a maximum centrifugal ratio of $\frac{1}{4}$ and a maximum

rate of change of acceleration of $0 \cdot 3 m / s^3$. The curve consists of a circular arc with two cubic spirals at the ends. Calculate the radius of the circular arc, the length of the transition, the total length of the combined curve and the chainages of all salient points if that of the intersection is 4200 m. 9

9. (a) When would you use a vertical curve? What are the different types of vertical curves? How would you compute the length of a vertical curve? 5

(b) An upgrade of 1% joins a downgrade of 0·5% at a point of chainage 885 m. The *RL* of this point is 140·250 m. Calculate the chainage of the beginning and end of a suitable vertical curve to join these gradients and determine the reduced levels of points on the curve at 30 m intervals. 9

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Code : 011508

B.Tech 5th Semester Exam., 2018

ADVANCED SURVEYING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer (any *seven*) :

(a) What is the curvature correction for a distance of 1000 m?

(i) 0·0785 m

(ii) 78·50 m

(iii) 67·03 m

(iv) 0·0673 m

(b) Reciprocal levelling eliminate the effect of

I. mistakes in staff reading

II. errors due to collimation line

III. errors due to atmospheric refraction

IV. errors due to earth's curvature

Choose the correct option.

(i) I and II

(ii) I, II and III

(iii) I, III and IV

(iv) III and IV

(c) Generally the transition curve used in highways is

(i) cubic parabola

(ii) cubic spiral

(iii) clothoid

(iv) Bernoulli's lemniscate

(d) The reference plane in the altitude and azimuth system of coordinate is

(i) equatorial

(ii) prime vertical

(iii) horizontal

(iv) None of the above

(e) The line of Indian standard time passes through

(i) Kanpur

(ii) Bhopal

(iii) Gujarat

(iv) Allahabad

(f) 1° latitude is equivalent to a distance of

(i) 105 km

(ii) 111 km

(iii) 405 km

(iv) 587 km

(g) In triangulation, the tower used is known as

(i) heliotrope

(ii) hunter

(iii) bibly

(iv) None of the above

(h) An equation of weight K is added to constant C. The weight of resulting equation is

(i) K

(ii) $K + C$

(iii) K / C

(iv) KC

(i) The radius of circular curve is 5 times the length of transition curve. The spiral angle is

(i) 0·1 rad

(ii) 0·01 rad

(iii) 0·2 rad

(iv) 0·05 rad

(j) The radius of a simple circular curve is 400 m and 120° deflection angle. The mid ordinate is

(i) 400 m

(ii) 600 m

(iii) 200 m

(iv) 800 m

2. (a) List the various methods of setting out a simple circular curve. Explain briefly the Rankine method of deflection angles.

(b) What is transition curve? State the various types of transition curves with the help of a neat sketch. Explain briefly its necessity.

3. What is compound curve? A compound curve is composed of two arc of radii 305 m and 520 m, the resulting deflection angle due to the combined curve is 110° and due to first arc of radius 305 m is 50°. If chainage of first point is 5056·5 m, then find the chainages of other salient points.

4. *(a)* Explain the methods of locating the soundings.

(b) What is hydrographic surveying? Explain its use in surveying.

5. Explain the procedure of reciprocal levelling. In levelling between the two points *A* and *B* on opposite banks of a river, the level was set up near *A* and the staff readings on *A* and *B* were 2·150 m and 3·565 m, respectively. The level was then moved to *B* and the respective staff readings on *A* and *B* were 1·965 m and 3·260 m. Find the true difference in levels *A* and *B*.

6. How do you determine the inter-visibility of triangulation station? Two triangulation stations *A* and *B* are 40 km apart and have elevations of 178 m and 175 m respectively. Find the minimum height of signal required at *B* so that line of sight may not pass nearer the ground than 3 m. The intervening ground may be assumed to have a uniform elevation of 150 m.

7. *(a)* Explain the method for determination of time.

(b) Explain the terms celestial sphere, celestial poles, celestial equator.

8. *(a)* Explain the difference between infra-red EDM and microwave EDM.

(b) Find the most probable error and most probable value of an area of a circle of radius (10·05 ± 0·02) m.

9. Write short notes on any *four* of the following :

(a) Summit and valley curves

(b) Determination of latitude

(c) Use of total station

(d) Laws of weight

(e) Curvature and refraction correction

(f) Three-point problem

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