

Exam.	Back		
	Level	BE	Full Marks
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

*Subject: - Surveying II (CE554)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain significance of traversing and describe about the accuracy parameters of horizontal and vertical control of traverse. [4]
2. Explain about the method of plotting of traverse in a standard grid sheet. [4]
3. Prepare the Gale's Table and find the co-ordinates of all the points if the co-ordinate of C is (1000N, 1500E) from the following data. [8]

S.No	Line	Length (m)	Bearing (WCB)
1	AB	66.60	30° 30'
2	BC	135.70	102° 48'
3	CD	66.30	95° 40'
4	DE	76.60	198° 8'
5	EA	214.30	284° 1'

4. Explain the principle of Tacheometric survey and also derive the formula to determine the horizontal distance and RL of the object with respect to instrument station when the staff is held in vertical. [8]
5. A tacheometer fitted with an anallatic lens and having multiplying constant of 100 was setup at station 'P'. The following readings were taken with the staff held vertically.

S.N	Staff Station	Bearing	Vertical Angle	Staff intercept	Axial hair reading
1	X	40° 35'	- 10° 20'	2.25	1.987
2	Y	70° 10'	+ 7° 30'	2.05	1.500

- Calculate the distance XY and the gradient between X and Y. [8]
6. What are the important characteristics of contour? Explain with sketches. [5]
  7. Explain about the reciprocal trigonometrical levelling and express the formula for computing elevation difference. [4]
  8. Stations A, B and C have the following respective coordinates (2876.24 mE, 8754.11 mN), (3810.80 mE, 7997.25 mN) and (2959.39 mE, 7487.09 mN) respectively. Station 'O' was established and following observations were recorded by a theodolite.

Pointing towards	Horizontal Circle Readings
A	90° 00' 00"
B	230° 58' 51"
C	313° 17' 05"
A	90° 00' 30"

Determine the coordinates of resection point 'O'. [7]

9. It is required to join two straights having a total deflection angle  $18^{\circ} 36'$  by a central circular curve of radius 450 m with two ends cubic spiral transition curves. The design velocity is 70 kmph and rate of change of radial acceleration is  $30 \text{ cm/sec}^3$ . Chainage of IP = 2524.20 m. Take Peg interval for circular and transition curve = 20 m for both. [8]

10. A grade of -0.7% is followed by another grade of + 0.5%. The two ends of these portions are connected by a parabolic vertical curve. The chainage and RL of intersection point are 1000 and 650 m respectively. Calculate RLs of all the points on the curve. Take peg interval of 20 m and rate of change of grade is 0.1% per 20 m. [8]

11. Write short notes on: (Any Four) [4x4]

- a) Importance of GPS and GIS
- b) Scale of vertical photograph and uses of photo grammetry
- c) Features of total station and its uses
- d) Types of remote sensing and its application
- e) Setting out of circular curve by Rankine's method

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying II (CE554)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) How a linked traverse is balanced? How total misclosure is balanced by Transit Rule? [6]  
 b) Calculate the omitted quantities in the closed traverse ABCDE given below. [10]

Line	Length	Bearing
AB	282.20	61°30'
BC	?	151°24'
CD	324.70	201°02'
DE	381.60	280°14'
EA	359.60	?

2. a) Compute RL of a hill station 'P' from two instrument stations A and B at very different level with same line of sight to that of target from the following informations. [5]

Inst St <sup>n</sup>	Inst ht	Target	Zenith angle		Distance & Target ht and RL
			FL	FR	
A	1.42	P	65°18'	304°36'	Distance between A and B = 120.00 m RL of B = 1280.00 m Target ht at B = 1.50 m
B	1.47	P	69°52'	290°00'	
A	1.42	B	102°52'	257°16'	

- b) What is stadia interval factor and additive constant? How these constants are determined? [3]  
 c) Following observations were made in a Tacheometric survey a station A of RL 1086.550, the height of instrument being 1.385 m. [8]

Inst. Station	H.I.	Staff Station	Bearing	Zenithal Angle	Staff Reading
A	1.385	B	18°00'	71°30'	1.295, 1.820, 2.345
		C	127°00'	96°00'	1.010, 1.790, 2.570

The instrument is fitted with an anallactic lens and the multiplying constants is 100. Determine the R.L of B and C and the gradient of line BC, and bearing of BC.

3. a) How do you define contour interval, contour gradient and index contour? Explain the main characteristics of Contours with neat sketch. [6]  
 b) What is the different between Intersection and Resection? Explain three point Resection Method to determine the unknown co-ordinate of a point. [4]

- c) The co-ordinates of three known stations Swoyambhu (S), Harisiddhi (D) and Chovar Temple (C) are given below. A traverse point "O" is set outside of this triangle and observations are taken for horizontal angle to these known co-ordinate points. Calculate the co-ordinate of station point "O".

[6]

Known Station	Horizontal Angle	Easting, m	Northing, m
Swoyambhu (S)	<SOD = 40°20'21"	627465.718	3066929.474
Harisiddhi (D)	<DOC = 98°56'41"	629603.054	6065364.275
Chovar Temple (C)	<COS = 220°42'58"	627612.753	3061479.468

4. a) Two roads BA and AC intersect at an angle of 150°. They are to be connected by a 4° circular curve. The chainage of point of intersection A is (138+20.3) chains. Compute all data necessary (i.e deflection angle, tangent length, apex distance, mod ordinate, length of curve, long chord for laying out the curve if only 30 m chain is used.

[6]

- b) State the function of transition curves. Derive the expression for deflection angle in transition curve that  $\alpha = \frac{573\ell^2}{RL}$  min

where,  $\ell$  = chord length

R = Radius

L = Length of transition curve

[5]

- c) A grade of 3.5% meets another grade of -0.5%. The elevation and chainage of intersection pt are 1267.00 m and 780.00 m respectively. Field condition requires that vertical curve should pass through a point of elevation 1266.00 m at chainage 780.00 m. Compute a suitable equal tangent vertical curve and full station elevation including highest point. Take peg interval = 30m.

[5]

5. Write short notes on: (Any four)

[4×4]

- Planning and taking of photographs and interpretation of aerial photograph
- Application of Remote sensing in surveying and mapping
- Working principle and Components of GPS
- Application of GIS in Civil Engineering
- Features and precautions taken in Total Station

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Exam.	New Back (2066 & Later Batch)		
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*Subject: - Surveying II (CE554)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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- ✓ Assume suitable data if necessary.

1. a) Explain different cases of omitted measurements in theodolite traversing. Explain plotting of traverse in grid sheet by co-ordinates method. [6]
- b) A link traverse was run between stations A and X. The co-ordinates of the controlling stations at the ends of the traverse are as follows: [10]

Stn.	E(m)	N(m)	Clockwise Angle	Length (m)
A	1769.15	2094.72	115°37'00"	A-1=208.26
B	1057.28	2492.39		
X	2334.85	1747.32	173°31'00"	4-X=224.79
Y	2995.85	1616.18		
1			168°19'10"	
2			281°12'40"	1-2=193.47
3			242°53'40"	2-3=326.71
4			80°26'20"	3-4=309.15

Calculate coordinates of stations 1, 2, 3 and 4. Adjust any mis-closure by transit method.

2. a) Find the gradient from P to Q using data below, [6]

Instru ment at	Staff at	Line	Bearing	Vertical Angle	Staff readings (m)
A	P	AP	84°36'	3°30'	1.35, 2.10, 2.85
A	Q	AQ	142°24'	2°45'	1.955, 2.860, 3.765

The staff was held vertical to the line of sight in both cases.

- b) Describe contour interval and horizontal equivalent. Explain characteristics of contour with neat sketches. [6]
- c) Describe tangential tachometry. Explain the field procedure of tachometric survey by total station for preparing topo map. [4]

3. a) Define intersection and resection. Derive the equation for any one method of resection for finding the coordinates of that unknown point. [2+6]

b) The top of the hill station 'P' was sighted from two instrument stations A and B located at very different level and in the same vertical plane to that of target and following observations were noted. [8]

Inst st <sup>n</sup>	HI (m)	Target	Zenith Angle		Distance	Target nt.
			FL	FR		
A	1.47	P	59°18'	300°36'	A to B = 112.00 m	-
B	1.42	P	69°52'	290°09'		-
C	1.42	A	85°32'	274°26'		1.75 m

If RL of "B" was 1280.00 m, find the RL of top of hill station.

4. a) Derive the formula for deflection angle ( $\alpha$ ) in transition curve,  $\alpha = 573 l^2/RL$  minute. [4]

b) In a road alignment a grade of (-)1% is followed by another grade of 0.5%. The chainage and RL of intersection pt are 1500 m and 1250 m respectively. The rate of change of grade is 0.1% /20 m. calculate the necessary data required for setting out of vertical curve by parabolic equation method take peg interval = 30 m. [6]

c) Compute and tabulate the data required for setting out a simple circular curve by Rankine's Method from the following information: [6]

- Angle of intersection = 150°00'
- Chainage of point of intersection = 1585.00 m
- Degree of curve = 3°
- Peg interval = 20 m, Normal chord = 20 m

5. Write short notes on: (any four) [4×4]

- i) Field procedure of aerial photogrammetry
- ii) Principle of GPS and its components
- iii) Features of total station and importance of total station
- iv) Components and sub system of GIS and its application
- v) Application of remote sensing

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1. a) What is omitted measurement? Explain the case when two affected sides are not adjacent. [4]

b) A link traverse was run between main traverse stations "B" and "M". Clockwise angles of link traverse taken were:  $ABX = 135^{\circ}00'30''$ ,  $BXY = 98^{\circ}07'55''$ ,  $XYM = 209^{\circ}45'02''$  and  $YMN = 64^{\circ}39'33''$  respectively. Lengths of link traverse are:  $BX = 31.612$ ,  $XY = 22.260$  m and  $YM = 36.153$  m respectively. The coordinates of main traverse stations given are: A (42.360 mN, 18.820mE), B (20.000mN, 30.000mE) and M (50.000mN, 100.000mE), N (70.600mN, 65.6670mE) respectively. Calculate the final coordinates of stations X and Y. Adjust any misclosure by Bowditch method. [12]

2. a) What is tacheometry? Explain the booking and plotting details in techeometric surveying. Calculate the gradient between station A and station B from the following observations taken from tacheometer fitted with anallactic lens. The RL and HI of instrument station P are 1275m and 1.55m respectively. [4+6]

Inst. Station	Target Station	Bearing	Vertical angle	Staff readings (m)
P	A	$30^{\circ}30'$	$6^{\circ}30'$	1.115, 1.735, 2.355
	B	$75^{\circ}30'$	$9^{\circ}15'$	1.250, 2.000, 2.750

b) Calculate the RL of top of tower P, base of which was not accessible from the two instrumentation stations X and Y. The top of the tower and the instrument stations were not in the same vertical plane. The observed zenithal angles from X to P and Y to P were  $30^{\circ}30'$  and  $29^{\circ}20'$  respectively. H.I. of instruments at X and Y were 1.57m and 1.50 m respectively and distance between them was 200 m. The horizontal angles observed were:  $PXY = 45^{\circ}45'$   $XYP = 60^{\circ}30'$  respectively. The back sights taken to BM with RL of 1000.00m were 1.8m and 0.8m from X and Y respectively. [6]

3. a) What is contour index? What are the different methods of interpolating contours? Explain them with appropriate examples and sketches. [8]

b) What is resection? Explain the two point problem. What is intersection? The coordinates of known stations A (7492 mN, 3932mE) and station B (7487mN, 2960mE). Calculate the coordinate of unknown point P, where the observed horizontal angles taken to P from A is  $44^{\circ}52'36''$  and to P from B is  $75^{\circ}33'22''$  respectively. [4+4]

4. a) Explain the setting out of simple circular curve by offsets from long chord. [4]
- b) It is proposed to insert a circular curve of 300m radius with a transition curve of length 60 m long each end of the circular curve. Prepare necessary data for setting out the combined curve in tabular form. Deflection angle between two alignments of road is  $45^\circ$  and chainage of intersection point is 2000m. Peg interval for transition and circular curve are 20 m and 30 m respectively. Take chainage at multiple of peg interval. [6]
- c) A grade of -3.5% meets another grade of +0.5%. The elevation and chainage of IP are 1267.00m and 780 m respectively. Field condition requires that the vertical curve should pass through a point of elevation 1268m at chainage 780m. Compute a suitable equal tangent vertical curve and full stations elevations when normal chord = 30 m. [6]
5. Explain the following: (any four) [4×4]
- Principle of stereoscopy, importance of aerial mapping
  - Application of remote sensing
  - Working principle and components of GPS
  - GIS and its components and subsystem
  - Features of total station and its importance.

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1. a) Explain the procedure of computation of omitted measurement, when two affected sides of traverse are not adjacent. [6]

b) The following observations are made in a traverse ABCDA. [10]

Traverse Leg	Horizontal Distance (m)	Traverse Station	Horizontal Angle		
			°	'	"
AB	71.5	A	78	41	25
BC	42.0	B	101	18	38
CD	70.0	C	89	59	41
DA	56.0	D	90	00	21

Bearing of CD = 314°58'04" Coordinate of C (500 m N, 500 m E)

Complete the Gale's Table with final adjusted length and bearing of each line.

2. a) Describe about the working principle of subtense bar tacheometry and derive subtense bar formula for computing horizontal and vertical distances when line of sight is inclined upward. [2+4]

b) It is required to determine the height (clear) of a Flood light tower in an arena by using a transit theodolite and for this zenith angles observation taken at 5 m and 2 m height on a target vane held on the plinth level of tower were 87°45' and 88°30' respectively. From the same instrument, zenith angle observed at top of the tower was found as 67°45'. If the RL of the instrument axis was 1200.00 m, Calculate the clear height (plinth to top) of the tower. [10]

3. a) Explain contour, contour interval, horizontal equivalent, index contour and the characteristics of contour with appropriate neat sketches. [8]

b) The following are the co-ordinates of three known station points whose directions are observed from the unknown instrument station P. [8]

	A	B	C
Easting (m)	5,000	10,000	15,000
Northing (m)	10,000	15,000	10,000

If observed horizontal angle APB = 45° and BPC = 52°

Determine (i) Length and Bearings of AP, BP and CP (ii) Co-ordinates of P.

4. a) Derive the expression that in a parabolic shaped vertical curve, RL of any curve point

$$P' \text{ is equal to } y_p = \frac{(g_2 - g_1)x^2}{200L} + \frac{g_1x}{100} + \text{RL of BVC}$$

Where,  $g_1$  and  $g_2$  are percentage of grade of two tangents, L is the total length of curve and x is the chord distance taken from BVC. Also find the formula to determine lowest and highest point of the curve. [6]

- b) A road 8 m wide is to deflect through an angle of  $60^\circ$  with the center line radius of 300 m, the chainage of intersection point being (3+605) Km. A transition curve is to be used at each end of the circular curve of such a length that the rate of change of radial acceleration is  $50 \text{ cm/sec}^3$ , when the speed of design vehicle is 70 Kmph, find out: [10]

- i) Length of transition curve
- ii) Super elevation
- iii) Chainage of tangent points and junction points
- iv) Deflection angles for first two points of transition curves and circular curve.

Take peg interval for transition curve = 10 m and circular curve = 20 m.

5. Attempt any four:

[4×4]

- a) Feature of total station and its importance
- b) Working principle and components of GPS
- c) Field procedure of aerial photogrammetry
- d) Application of remote sensing in engineering and mapping
- e) Components of GIS and its application

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Year / Part	II / II	Time	3 hrs.

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1. a) Describe consecutive and independent coordinates. Explain the plotting method of traverse by grid coordinates. [3+3]

b) In a four sided closed traverse ABCDA the following informations are given. [10]

Side	Length (m)	Deflection angle	Bearing	Coordinates
AB	280.00	?	S50°W	?
BC	360.00	85°00' Left	?	?
CD	320.00	135°00' Left	?	C=2500mE, 2500mN
DA	?	?	?	?

- i) Compute all missing figures.
- ii) Compute the coordinates of other points with respect to C.

2. a) Develop expression for H, V, and R.L for the tangential system of tachometry when the both sightings are angles of depression. [4]

b) Determine gradient and bearing of PQ. The staff was held vertical.  $K = 100, C = 0$ . [6]

Inst. St.	Staff St.	Bearing	Zenithal Angle	Staff Readings (m)		
				T	M	B
R	P	S60°E	79°28'	2.36	1.81	1.25
	Q	S30°W	95°06'	2.94	2.12	1.30

c) The top (Q) of a tower was sighted from two stations at very different level and in same vertical plane with Q. Find R.L of the top of tower from the following observed data: [6]

Inst. St.	H.I	R.L	Target	Zenithal angle
P	1.87 m	-	Q	51°39'
R	1.64 m	112.78 m	Q	68°42'

The distance between instrument stations P and R is 120 m.

The angle of elevation from R to 2 m. above the root of the staff held at P was 15°11'

3. a) Explain the factors that affect the contour interval. [4]

b) In a trigonometrical levellings a hill station "P" was sighted from two instrument station A and B which were at very different level but with same line of sight to that of target and following information were noted. [6]

Inst. st <sup>n</sup>	HI (m)	Target	Zenith	Angle	Distance
			FL	FR	
A	1.42	P	65°18'	304°36'	120.00m (st <sup>n</sup> A to St <sup>n</sup> B)
B	1.47	P	69°52'	290°00'	
A	1.42	B	102°52'	257°16'	

Determine the RL of P, if RL of ground point B was 1280.00 m and vane height while sighting from A to B was 2.50 m above the foot of the vane.

- c) In two point resection problem, if two known points A and B having coordinates (6928.474 mN, 7464.418 mE) and (5363.275 mN, 9602.054 mE) are given. From two points C and D located south and west of AB, angles observations are:  $\angle ACB = 70^\circ 35' 48''$ ,  $\angle DCA = 52^\circ 25' 35''$ ,  $\angle ADB = 65^\circ 27' 35''$  and  $\angle BDC = 32^\circ 16' 42''$ . Determine the coordinates of resection point "C" [6]
4. a) Derive the formula for deflection angle ( $\alpha$ ) in transition curve,  $\alpha = 573 l^2/RL$  minute. [4]
- b) Calculate the R.L.s of pegs on a vertical curve connecting two grades of -0.5% and +0.7% at the intersection point which has chainage = 1000 m and R.L = 500 m. The rate of change of grade is 0.1% per 30 m. Take peg interval = 20. [6]
- c) Compute the data for setting out a simple circular curve by Rankines deflection angle method from the following informations: [6]
- Angle of intersection =  $145^\circ 0'$   
 Chainage of point of intersection = 1580 m  
 Degree of curve =  $5^\circ$   
 Least count of the theodolite =  $10''$   
 Peg interval = 30 m
5. Write short note on: (any four) [4×4]
- a) Field procedure of aerial photogrammetric
  - b) Application of remote sensing in engineering and mapping
  - c) Working principle and components of GPS
  - d) Components of GIS and its application
  - e) Features of total station and its importance

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1. a) Define closed loop and closed link traverse. Also explain angular misclosure balancing process in linked traverse. [6]
- b) A traverse ABCDA was conducted and the following data were obtained. It was required to connect the midpoint E of CD to the midpoint F of AB. Find the length and bearing of EF. [10]

Line	Length	Bearing
AB	610.00	N 80°10' E
BC	510.00	N 13°00' E
CD	1130.00	S 80°10' W
DA	450.00	S 15°30' E

2. a) State the principle of stadia tacheometry and describe the field procedure of tacheometry survey for preparing topographic map. [8]
- b) A tachometric survey was done to find the gradient between X and Y. Tacheometer consist of an anallatic lens was used and following observations were made from section R on vertical staff. [8]

Inst. Stn.	Staff point	Stadia hair readings	Vertical angle	Bearing
R	X	0.915, 1.750, 2.585	+15°	345°
	Y	0.760, 2.240, 3.715	+10°	75°

3. a) How can you measure the horizontal distance and elevation of an inaccessible object when the instrument positions are at very different levels; instrument stations and the elevated object are in the same vertical plane. [8]
- b) The co-ordinates of three known stations Swayambhu, Dharara and Chovar temple is given below. [8]

Known station	Horizontal angle	Easting	Northing
Swayambhu (S)	$\angle S \times D = 41^\circ 20' 21''$	627464.718	3066928.474
Dharara (D)	$\angle D \times C = 97^\circ 56' 41''$	629602.054	3065363.275
Chovar Temple (C)	$\angle C \times S = 220^\circ 42' 58''$	627611.753	3061479.468

A theodolite is set up over an unknown point X. Calculate the co-ordinates of station X using the Tienstra method.

4. a) Describe index contour and explain indirect method of contouring for field control. [1+5]
- b) A road 8m wide is to deflect through an angle of  $60^\circ$  with the center line radius of 300m, the chainage of intersection point being 3605m. A transition curve is to be used at each end of circular curve of such a length that the rate of gain of radial acceleration is  $0.5 \text{ m/s}^3$ , when the speed is 50 km/h. Find out: [10]
- length of transition curve
  - superelevation
  - chainage of all tangent points and junction points
  - Calculate the first two deflection angles for transition curve, and first two deflection angles for circular curve. Take peg interval = 10m for transition curve and 20m for circular curve.
5. Write short notes on: (any four) [4×4]
- Working principle and components of GPS
  - Relief displacement and its expression
  - Application of remote sensing in civil engineering
  - Features of total station and its importance
  - Component of GIS and its application

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10/12

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1. a) When would you suggest a theodolite traversing by the method of deflection angles? Explain with neat sketches. [6]

b) The following data refers to a traverse ABCDE. Determine the bearings of the sides DE and EA. [10]

Line	AB	BC	CD	DE	EA
Length (m)	230.50	250.20	210.80	240.30	265.40
Bearing	N 36°45' E	S 82°48' E	S 10°15' E	?	?

2. a) The co-ordinates of stations S and A are (1309.12 m E, 1170.50 m N) and (1525.43 m E and 956.87 m N) respectively. Calculate the co-ordinates of point B which has been located by intersection from stations S and A observing the following angles.  $\angle BSA = 85^\circ 38' 49''$  and  $\angle SAB = 55^\circ 50' 33''$ . [8]

b) Calculate the elevation difference and gradient between stations A and B from the given data which are observed by a tacheometer from station R. Staff was vertically held at A and subtense bar at B. The subtended angle between the instrument and 2m long subtense bar was  $00^\circ 42' 15''$  [8]

Instrument Station	Sighted to	Bearing	Zenith angle	Staff readings (m)	Subtense bar height
R	A	345°00'	96°30'	0.650, 1.250, 1.850	X
R	B	225°00'	85°00'	X	1.180 (m)

3. a) Explain the direct method of contouring and write the uses of contour map. [6]

b) In a road alignment a falling grade of 1% is followed by rising grade of 0.5%. The chainage and RL of the intersection point are 500 and 350 m respectively. The rate of change of grade is 0.1% per 20 m. Calculate the necessary data required for setting out the vertical curve, take peg interval of 30 m. [10]

4. a) Explain degree of curve with neat sketch. Derive the formula of Tangential angle,  $\alpha = \frac{90^\circ C}{\pi R}$  and deflection angle  $\Delta_n = \delta_1 + \delta_2 + \delta_3 + \dots + \delta_n$ . [8]

b) The top of temple was sighted from two stations A and B at very different level. The observed vertical angle from A and B to top of temple 'P' were  $30^\circ 36'$  and  $20^\circ 12'$  respectively. The vertical angle B to A to a vane at 1.5 m above the foot of the vane was  $4^\circ 15'$ . The height of instrument at A and B were 1.47 m and 1.42 m. The distance between two instrument station was 112 m. RL of B was 1280.00 m. Find the RL of the top of the temple. Also apply the correction for refraction and curveturate. [8]

5. Write short notes on: (any four) [4×4]

- a) Working principle and components of GPS
- b) Importance and uses of photogrammetry
- c) Application of remote sensing in Civil Engineering
- d) Features, importance and uses of Total Station
- e) Component and subsystem of GIS and its application

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying II (CE554)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Write the field measurements required in theodolite traversing and explain closed and open traverses. [4+4]

- b) Balance the following coordinates and compute the total coordinates for a link traverse XABCY using Bowditch's rule. The given coordinates of X and Y are (1877.51 mN, 1290.20 mE) and (1626.50 mN, 1578.87 mE) respectively. If permissible closing error is 1:500, justify your assessment. Other observed data are as follows: [8]

Lines	XA	AB	BC	CY
Length (m)	120.00	111.50	132.40	97.60
Bearing	135°00'	119°30'	175°00'	77°30'

2. a) The following observation were made with a tacheometer. The staff was held vertical (constants are 100 and 0). [8]

Inst. St	Staff St	Bearing	Vertical angle	Staff	Readings	
R	P	100°	+8°20'	2.60	1.85	1.10
	Q	200°	-2°30'	2.50	1.91	1.32

Find the gradient between P and Q.

- b) Explain the method of trigonometrical levelling to determine the elevation of inaccessible object when the instrument stations and the object are in different vertical plane. [8]
3. a) Explain about the characteristics of contour lines with clear supporting sketches. [8]
- b) Explain any one method of analytical resection. [8]
4. a) Prepare a table giving all necessary data for setting out a vertical curve. [10]

In a road alignment a grade of -4.5% followed by +3.5%, R.L. of I.P. = 1000 m chainage of IP = 1500 m connect the two grade by a parabolic curve 200 m long. Take peg interval = 20 m.

- b) Determine the expression for the scale of vertical photograph. [6]
5. Write short notes on: (any two)
- a) Write the working principle of GPS, its components and uses. [8]
- b) Working principle of total station, its importance and uses in surveying and mapping. [8]
- c) Write the components of GIS. [8]



Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject:** - Surveying II (CE557)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain in brief field procedure of traverse survey between two known stations. [6]
- b) Below given table lists measured angles to the right for the traverse. The bearings A-X and E-Y have known value of  $139^{\circ}05'45''$  and  $86^{\circ}20'47''$  respectively. Adjust this traverse for departure and latitude misclosure. [10]

Status	Length	Measured angle
A	-	$283^{\circ}50'10''$
	1045.50	
B	-	$25617'18''$
	1007.38	
C	-	$98^{\circ}12'41''$
	897.81	
D	-	$103^{\circ}30'34''$

2. a) In what situation reciprocal trigonometrically levelling is conducted? Derive a relation for determining the reduced level of a hill top when two instrument stations and target point are at different vertical plane. [6]
- b) A 2 m long subtense bar was placed above station B and the angle subtended at station A was read as  $02^{\circ}40'20''$ . Intermediate level information was later recorded using a theodolite with tachometric constants 100 and 0 at station C and the staff was held vertical. The following data were recorded on to stations A and B. [10]

Inst st <sup>n</sup>	Sighted to	Horizontal circle	vertical angle	Staff readings (m)
C	A	$00^{\circ}00'00''$	$-05^{\circ}10'00''$	1.459, 1.649, 1.839
hi = 1.55 m	B	$80^{\circ}24'20''$	$+10^{\circ}23'30''$	-, 1.235, -

Find the difference in elevation and distance between A and B, the horizontal angle ACB was  $60^{\circ}0'00''$  *39.04 m*

3. a) What is mean by contour interpolation? Which method do you suggest for contour interpolation in large volume of work and how would you applied it? [6]
- b) A, B and C are three visible stations in a location survey. The computed sides of the triangle ABC are  $AB = 1200$  m,  $BC = 1442$  m and  $CA = 1960$  m. A station 'O' is established outside the triangle and its position is to be determined by resection on A, B and C. The angles AOB and BOC being  $45^{\circ}30'$  and  $52^{\circ}15'$  respectively. Determine the distances of OA and OC. [10]
4. a) Describe elements of transition curve. [6]
- b) A road curve of 180 m radius is to be set out to connect two tangents. The maximum speed of this part of the road will be 13.2m/sec. Transition curves are to be introduced at each end of the curve. Find a suitable length of transition curve and circular curve including the value of first two deflection angles of each curve. [10]
- a) With the help of neat sketch describe relief displacement on a vertical photograph. [6]
- b) Explain in brief GPS field procedure. [5]
- c) Discuss the uses and advantages of satellite imagery. [5]

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying II (CE554)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) For a closed traverse ABCDA, compute the missing data. [8]

Line	Length(m)	Bearing
AB	100.00	N 45° 30' W
BC	605.00	N 5° 30' E
CD	95.00	N 88° 20' E
DA	?	?

- b) What are closed and open traverse? Explain consecutive and independent co-ordinates with examples. [8]
2. a) The following readings were taken by a tacheometer with the staff held vertical. The tacheometer is fitted with an anallactic lens and the multiplying constant is 100. find out the horizontal distance from A to B and gradient of AB. [10]

Instrument station	Staff Station	Vertical angle	Staff readings	Remarks
A	BM	-6°30'	1.100, 1.153, 2.060	RL of BM = 970.00m
	B	+10°0'	0.982, 1.105, 1.188	

- b) Derive an expression to find the RL of an inaccessible object when the instrument and the object are not in the same vertical plane. [6]
3. a) What are the methods of contouring? Explain briefly. Write the uses of contour maps. [8]
- b) What is analytical resection? Derive an expression to find the co-ordinates of unknown points by observations to three known points. [8]
4. a) Calculate the RLs of pegs on a vertical curve connecting two grades of +0.5% and - 0.7% at the point of intersection. The chainage and RL of intersection point are 500m and 350.750m respectively. The rate of change of grade is 0.1% per 30m. [8]
- b) Find the elements of simple circular curve. [4]
- c) Define: (i) Tilted photograph (ii) Side overlap (iii) Principal point (iv) Flying height [4]
5. a) What is GPS? Write the components and working principle of GPS. [8]
- b) Explain the working principle of total station. Write its importance and uses in surveying and mapping. [8]

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Exam.	Regular		
	Level	BE	Full Marks
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying II**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) What are closed and open traverses? Explain transit rule for balancing the traverse. [7]
- b) Balance the coordinates of a link traverse XABCY using Bowditch's rule. The coordinates of stations X and Y are (1162.510N, 775.250E) and (1043.610N, 1043.610E) respectively and permissible closing error is 1:500. Other observed data are given below: [9]

Lines	XA	AB	BC	CY
Length (m)	120.00	111.50	132.40	97.60
Bearings	135°00'	119°30'	175°00'	77°30'

2. a) What is contour gradient? Write characteristics of contours with suitable sketches. [7]
- b) The following observations were taken from the traverse station A and B. The staff was held vertical. The tachometer is fitted with anallactic lens. Multiplicative constant = 100. [9]

Traverse station	H.I. (m)	Staff Station	Bearing	Vertical angle	Staff reading
A	1.50	C	15°14'	+8°9'	2.60 1.85 1.10
B	1.53	D	340°18'	+2°3'	2.50 1.91 1.32

Independent coordinates of A is (800, 1800)  
 Independent coordinates of B is (950, 2500)  
 Compute the length and bearing of CD.

3. a) What is degree of curve? Describe the elements of simple circular curve. [7]
- b) Design a composite curve with the following data: Deflection angle = 60°, Maximum speed of vehicle = 40km/hr, centrifugal ratio = 1/8, rate of change of radial acceleration = 0.30m/sec<sup>3</sup>, chainage of IP = 1150m. Also calculate the setting out data of circular curve by Rankine's method. Take peg interval = 20m. [9]
4. a) What is GPS? Write about the principles of GPS and its components and applications. [9]
- b) Explain any one method of analytical resection to calculate the position of instrument station. [7]
5. Write short notes on: (any two) [8×2]
- a) Components of GIS and applications of GIS in Civil engineering
  - b) Features of total station and its operations
  - c) Remote sensing and its applications

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Exam.	Regular/Back		
	Level	BE	Full Marks
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying II**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) What are the field measurements necessary in theodolite traversing? Explain Bowditch's rule for balancing the traverse. [6]

b) In a four sided closed traverse ABCDA, the following informations are given: [10]

Side	Length (m)	Deflection angle	Bearing	Coordinates		Remarks
				Northing	Easting	
AB	160	?	S 40°00' W	?	?	Coordinates of B.
BC	340	116°00' (L)	?	26500	22400	
CD	210	60°00' (L)	?	?	?	
DA	?	?	?	?	?	

Find the missing data.

2. a) Describe the working principle of subtense bar. Derive an expression to find the horizontal distance and height difference between the instrument station and staff point in the case of fixed hair method, line of sight is inclined and staff held vertical. [7]

b) A tachometer is placed at a station A and readings on a staff held upon a B.M. of R.L. = 1000.00 and station B are 0.640, 2.200, 3.760 and 0.010, 2.120, 4.230 respectively. The angle of depression of the telescope in the first case is  $-6^{\circ}19'$  and in the second case  $-7^{\circ}42'$ . Find the horizontal distance from A to B and R.L. of the station B. (Constants are 100 and 0.3) [9]

3. a) Describe the principle characteristics of contour lines with supporting sketches and uses of contour map. [8]

b) The top of a hill station P was sighted from two stations A and B at a different level and at the same vertical plane with the target. The zenith angle from A to P and B to P were  $59^{\circ}15'$  and  $69^{\circ}45'$  respectively. The zenith angle from A to B to a vane 1.5m above the foot of the vane was  $105^{\circ}30'$ . If the height of instrument of A and B were 1.45m and 1.35m respectively and distance between A and B was 150m, and RL of B was 120.00m. Find the RL of hill station (if target is 3.5m above the ground). [8]

4. a) Derive the expression of the three point analytical resection. [8]

b) Two tangents which deflect at an angle of  $37^{\circ}46'$  are to be connected by a circular curve of 2000m radius with a transition curve at either end. The chainage of the point of intersection is (3436+26) chains. Find the chainages of the beginning and end of the three curves and draw a table of the deflection angles for chords of 15m for each transition curve. Assume velocity = 160 km/hr, rate of change of radial acceleration =  $0.3\text{m/sec}^3$ , chain used was 30m length. [8]

5. a) Define vertical and horizontal control. Describe the process of measurement of velocity and flow of stream. [8]

b) A down grade of 3.5% is followed by an upgrade of 4.5%. The reduced level and chainage of IP are 900.00m and 2450.00m respectively. A vertical parabolic curve 180m long is to be introduced to connect the two grades. The pegs are to be fixed at 20m intervals. Calculate the RLS of curve points including lowest point [8]

6. Write short notes on: (any two) [8×2]

- a) Global Positioning System
- b) Photogrammetry its limitation and uses
- c) Location of sounding point in hydrographic survey
- d) Setting out vertical curve



Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying II**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) What is traverse? Explain in brief about traverse computation process. [6]  
 b) Given the following latitudes and departures of traverse ABCDEA, the bearings of AB and EA having been omitted. [10]

Line	Latitude (m)	Departure (m)	Length (m)
AB	---	---	1970
BC	+841.11	+336.71	
CD	+877.18	-311.74	
DE	-700.60	-727.88	
EA	---	---	1181

Determine the bearings of AB and EA.

2. a) What is the use of subtense bar? Write the working principles of subtense bar. [6]  
 b) Discuss importance of trigonometrical levelling. Derive an expression to find the R.L. of an inaccessible object when the instrument stations are in the different vertical plane. [10]
3. a) Discuss about the principal characteristics of contour lines with supporting neat sketches. [6]  
 b) The following observations were made on a vertically held staff with a tacheometer fitted anallactic lens having multiplying constant of 100. [10]

Instrument Station	Height of Instrument	Staff Station	Bearing	Zenith Angle	Hair Reading	Remarks
O	1.55	A	30°30'	85°30'	1.155, 1.755, 2.355	RL of
		B	75°30'	101°15'	1.250, 2.000, 2.750	0 = 450.80m

Calculate the distance AB and RL<sub>s</sub> of A and B. Find the gradient of the line AB.

4. a) Derive the expression for three point resection problem. [8]  
 b) A down grade of 4.5% is followed by an upgrade of 3.5%. The reduced level and chainage of the point of intersection level and chainage of the point of intersection are 900.00m and 450.00m respectively. A vertical parabolic curve 180m long is to be introduced to connect the two grades. The pegs are to be fixed at 20m intervals. Calculate including lowest point also. [8]
5. a) Describe about the setting out techniques of right hand side composite curve. [6]  
 b) Two straights AB and BC intersect at the chainage (1+400) kilometer, the deflection angle being 40°00'. It is proposed to layout a circular curve of 400m radius with a cubic parabola of 90m length at each end. Peg intervals for circular and transition curve re 20m and 30m respectively. Calculate tangential angles for first two points on transition curve, deflection angles for two points on the circular curve and chainage at the beginning and at the end of this composite curve. [10]
6. Write short notes on any two: [8×2]  
 a) Global positioning system (GPS)                      b) Location of sounding points  
 c) Remote sensing and its application

Exam.	Regular/Back		
	Level	BE	Full Marks
Programme	BCE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

**Subject: - Surveying**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. a) What are closed and open traverses? Explain Bowditch's rule for balancing the traverse. [7]
- b) The following data refers to a traverse ABCDE. Determine the bearings of the sides BC and CD. [9]

Line	Length in (m)	Bearing
AB	306.00	164°00'
BC	432.00	?
CD	324.00	?
DE	302.40	328°00'
EA	629.43	269°06'

2. a) Write working principle of a subtense bar. How precision can be increased by using subtense bar for computed distance. [7]
- b) The following observations were taken in a tacheometric survey from a station A of R.L. 1086.550, the height of instrument being 1.385m. [9]

Instrument Station	Height of Instrument	Staff Station	Bearing	Zenithol	Stadia Reading
A	1.385	B	18°00'	71°30'	1.295, 1.820, 2.345
		C	127°0'	96°00'	1.010, 1.790, 2.570

The instrument is fitted with an anallactic lens and the multiplying constant is 100. Determine the R.L. of B and C and the gradient of the line BC.

3. a) Write characteristics of contours and illustrate with suitable sketches. [9]
- b) Explain the method of determining the R.L. of an inaccessible object when the instrument stations and object are in different vertical plane. [7]
4. a) What is degree of curve? Find the elements of a composite curve including sketch. [7]
- b) Two tangents intersect at chainages 1190m, the deflection angle being 36°. Calculate all the necessary data for setting out a curve with a radius of 300m, by deflection angle method. Take peg interval of 30m. Also provide check to support the calculation during setting out. [9]
5. a) Derive the expression that the tangential angle for points on the circular curve is equal to  $1718.87 \times C/R$  and also express about the deflection angles for laying out of circular curve. [6]
- b) A 2% down gradient meets a 3% up gradient at a chainage of 2600m, the RL of the point of intersection being 1200.00m. A vertical parabolic curve is to be set out to connect two grades with pegs at 20m interval. The rate of change of grade is 0.5% per 20m chain. Tabulate the chainages and RLS of the station pegs including lowest point on the curve. [10]
6. Write short notes on (any two): [8×2]
  - a) Analytical resection
  - b) Under water mapping
  - c) Global Positioning System (GPS)