CONTENTS

EXPERIMENT – 1(A)

TRIGONOMETRICAL SURVEYING & TACHEOMETRY

AIM OF THE EXPERIMENT:

Determination of height of 3 objects whose bases are accessible

APPARATUS REQUIRED:

Theodolite, Tripod, Tape, Ranging Rods, and Plumb Bob etc.

THEORY:

Trigonometric levelling is the process of determining the differences of elevations of stations from observed vertical angles and known distances, which are assumed to be either horizontal or geodetic lengths at mean sea level. This method is usually employed when the distance between the instrument station and the base of the object is small. However, if the distance is large, the combined correction for curvature and refraction can be applied.

PROCEDURE:

Let A be the inaccessible point whose elevation is required.Let B be its projection on the ground which is accessible.

1. Set up the theodolite at C at a distance of D meters from B and level it accurately by the altitude level.
2. With the line of sight horizontal, take a staff reading h on the bench mark established nearby the instrument.
3. Sight to point A and observe the vertical angle α subtended at the line of collimation, both on face left and face right and take the average of the two values.
4. Measure the horizontal distance BC accurately by tape.

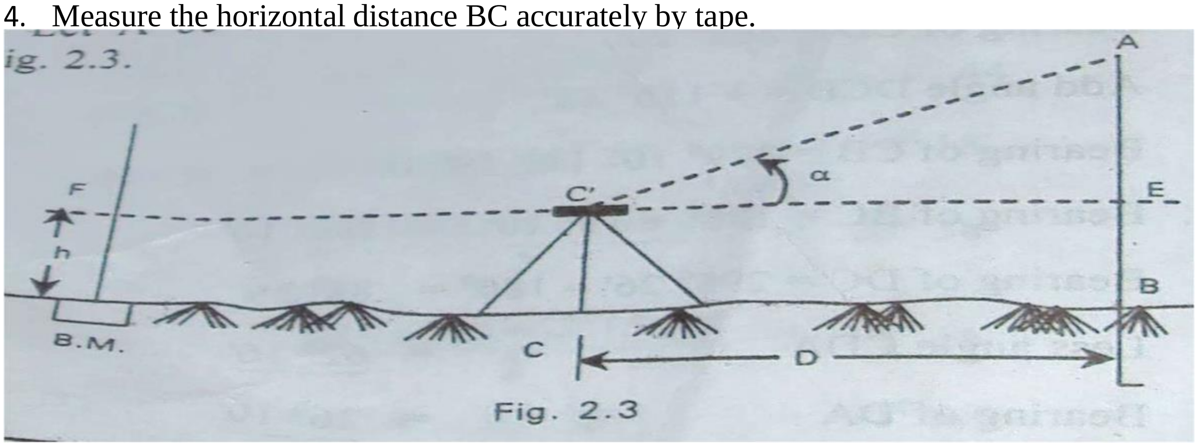

Fig. 2.3

Observations and calculations:

Let C= instrument station

A = point to be observed

C^l = Centre of the instrument

E = projection of Q on horizontal plane through AD = BC = horizontal distance between C and A

h^l = height of the instrument at Ch = AE

S = reading of staff kept at B.M., with line of sight horizontalα = angle of elevation from A to Q

From triangle C^lAE ; h = D tanα

R.L. of A = R.L. of instrument axis + D tanαIf the R.L. of C is known,

R.L. of A = R.L. of C + h^l + D tanα

If the reading on the staff kept at the B.M. is S with the line of sight horizontal,

R.L. of A = R.L. of B.M. + S + D tanα

If the distance D is large, combined correction for curvature and refraction has to be applied.

R.L of A = R.L of B.M + S +D tan α-0.0673$(D/1000)^2$

Instrument at	Sight to	Face left			Face right			Average angle
		C	D	MEAN	C	D	MEAN	

Result: The elevation of the inaccessible point Q is ______________

Name of the Student:
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EXPERIMENT – 1(B)

AIM OF THE EXPERIMENT:

To find the R.L. of the elevated point when the base of the object is not accessible.

APPARATUS REQUIRED: Theodolite, Tripod, Tape, Ranging Rods, and Plumb Bob etc.

THEORY

Trigonometric leveling is the process of determining the differences of elevations of stations from observed vertical angles and known distances, which are assumed to be either horizontal or geodetic lengths at mean sea level. This method is usually employed when the horizontal distance between the instrument and the object can be measured due to obstacles etc., two instrument stations are used so that they are in the same vertical plane as the elevated object.

PROCEDURE:

Let A be the inaccessible point whose elevation is to be determined

1) Set up the theodolite at station B at a convenient position so that the object A can be sighted and level the instrument accurately by the altitude level.
2) With line of sight horizontal, take the staff readings s1 on a nearby B.M. to establish the R.L. of the plane of collimation
3) Sight object A and read the vertical angle EB'A=$\alpha 1$.
4) With both motions of plates clamped, plunge the telescope and mark a station C in the lineof sight at a suitable distance d from B so that points, A, B, C lie in the same vertical plane.
5) With line of sight horizontal, take the staff readings s1 on a nearby B.M. to establish the R.L.of the plane of collimation.
6) Shift the instrument and set it up exactly over C and level it accurately.
7) With line of sight horizontal, take the staff reading s2 on the B.M. to establish the level of plane of collimation at C.
8) Sight object A and read the vertical angle $\alpha 2$ to A from C^l.

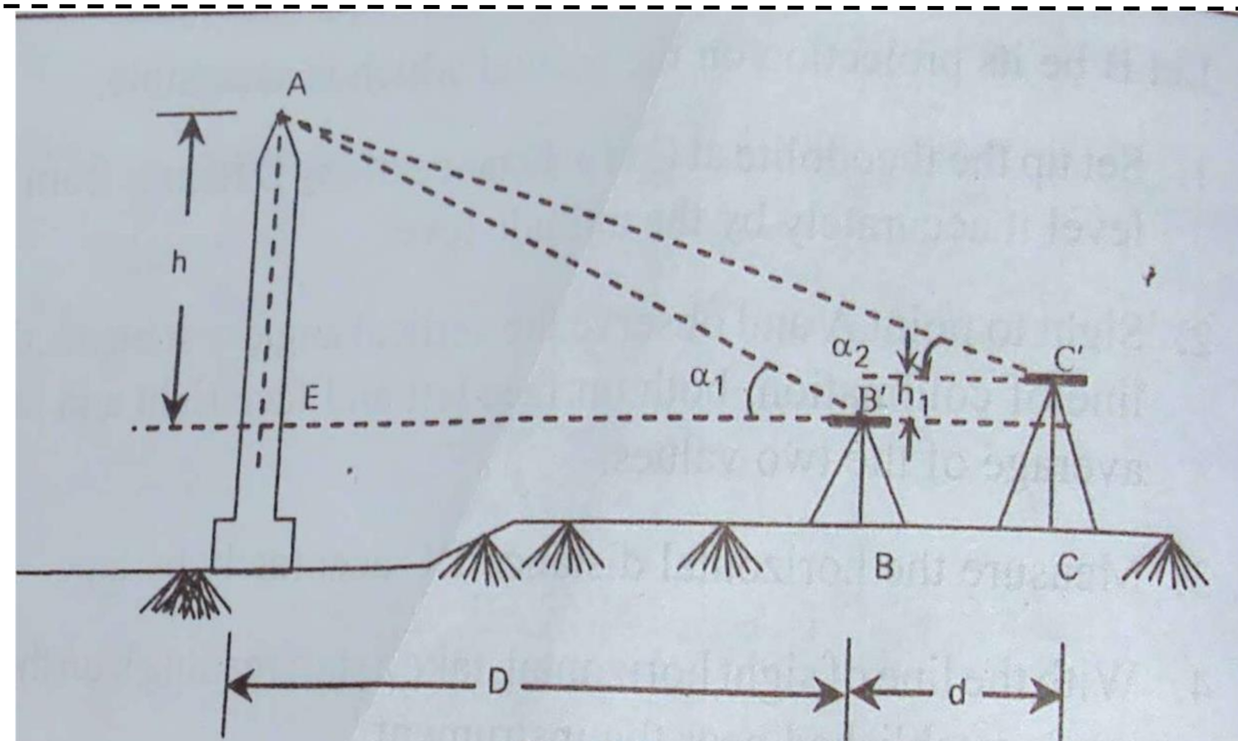


Fig. 2.4

OBSERVATIONS AND CALCULATIONS:

From triangle EB^lA, $h_1 = D \tan\alpha 1$.................................... (1)

From triangle FC^lA, $h_2 = D \tan\alpha 2$.................................... (2)

Subtracting (2) from (1), we get

$$h_1 - h_2 = D \tan\alpha_1 - (b + D) \tan\alpha_2$$

But $h_1 - h_2$ = difference in level of instrument axes = $S_2 - S_1$ = s (say)$s = D \tan\alpha_1 - b \tan\alpha_2 - D \tan\alpha_2$

$$s + b \tan\alpha_2 = D (\tan\alpha_1 - \tan\alpha_2)$$

$$D = \frac{s + b \tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$$

From (1), $h_1 = D \tan\alpha_1$

$$h_1 = \frac{s + b \tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2} \times \tan\alpha_1$$

R.L of A = R.L of B.M + $s_1 + h_1$
R.L of A = R.L of B.M + $s_2 + h_2$

Instrument at	Sight to	Face left			Face right			Average angle
		C	D	MEAN	C	D	MEAN	

Result: The elevation of the inaccessible point Q is _

Name of the Student:
Registration No. : **Signature of Teacher**

EXPERIMENT – 1(C)

AIM OF THE EXPERIMENT:

To determine the elevation of an inaccessible point when both angles are in elevation by tacheometric surveying.

APPARATUS REQUIRED: Theodolite, tape, cross staff, arrows, tripod etc..

THEORY

The Tacheometer is an instrument which is generally used to determine the horizontal as well as vertical distance. It can also be used to determine the elevation of various points which cannot be determine by ordinary leveling. When one of the sight is horizontal and staff held vertical then the RLs of staff station can be determined as we determine in ordinary leveling .But if the staff station is below or above the line of collimation then the elevation or depression of such point can be determined by calculating vertical distances from instrument axis to the central hair reading and taking the angle of elevation or depression made by line of sight to the instrument made by line of sight to the instrument axis.

OBSERVATIONS AND CALCULATIONS:

Let P = position of the instrumentQ = staff station

M = position of instrument axisA, B = position of vanes

S = distance between the vanes (staff intercept)α_1

= angle of elevation corresponding to A

α_2 = angle of elevation corresponding to B

D = horizontal distance between P and Q = MQ^l

V = vertical intercept between the lower vane and the horizontal line of sighth

= height of the instrument of MP

r = height of the lower vane above the foot of the staff

= staff reading at lower vane = BQ

From triangle MBQ^l, $V = D \tan\alpha_2$

From triangle AMQ^l, $V + s = D \tan\alpha_1$

$S = D \tan\alpha_1 – D \tan\alpha_2$

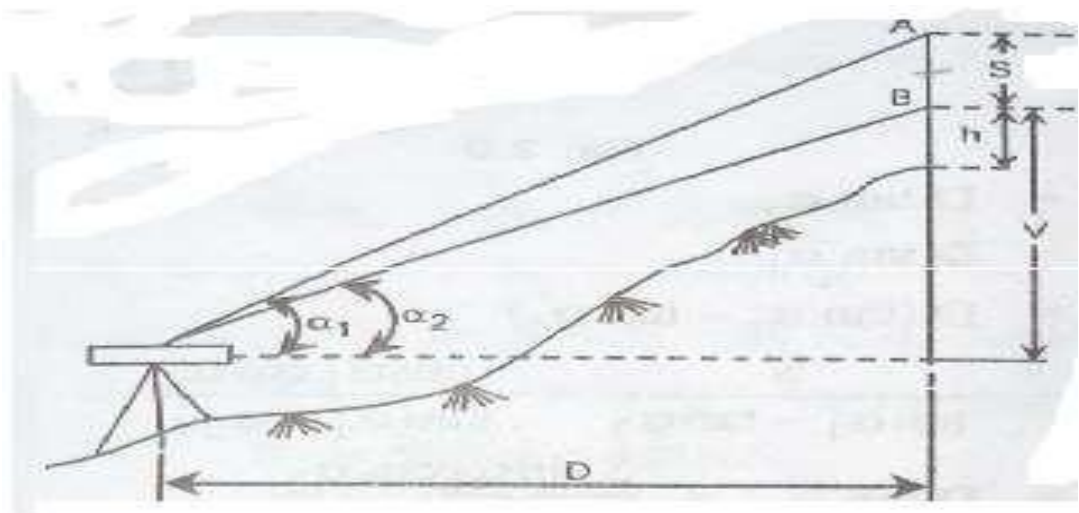
$$D = \frac{s}{\tan\alpha_1 - \tan\alpha_2} = \frac{s\cos\alpha_1\cos\alpha_2}{\sin(\alpha_1 - \alpha_2)}$$

$$V = D\tan\alpha_2 = \frac{s\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2} = \frac{s\cos\alpha_1\sin\alpha_2}{\sin(\alpha_1 - \alpha_2)}$$

Elevation of Q = (Elevation of station + h) + V – r

PROCEDURE:

1. Set up the instrument at P and level it accurately by carryout the temporary adjustments.
2. Set vernier reading to zero making line of sight horizontal.
3. Take the first staff reading on Benchmark and determine height of instrument and let it be h.
4. Then sight the telescope towards the staff station whose R.Ls are to be calculated.
5. Measure the angle on vernier if line of sight is inclined upward or downward and also note the three crosshair readings.
6. Determine the R.Ls of various points by calculating the vertical distance



Result: The elevation of an inaccessible point is =

Name of the Student:
Registration No. : **Signature of Teacher**

EXPERIMENT – 1(D)

AIM OF THE EXPERIMENT:

To determine the elevation of an inaccessible point when both angles are in depression bytacheometric surveying.

APPARATUS REQUIRED: Theodolite, tape, cross staff, arrows, tripod etc..

THEORY

The Tacheometer is an instrument which is generally used to determine the horizontal as well as vertical distance. It can also be used to determine the elevation of various points which cannot be determine by ordinary leveling. When one of the sight is horizontal and staff held vertical then the RLs of staff station can be determined as we determine in ordinary leveling .But if the staff station is below or above the line of collimation then the elevation or depression of such point can be determined by calculating vertical distances from instrument axis to the central hair reading and taking the angle of elevation or depression made by line of sight to the instrument made by line of sight to the instrument axis.

OBSERVATIONS AND CALCULATIONS: With the same notations as earlier

$V = D \tan\alpha_2$ .... (1)

$V - s = D \tan\alpha_1$ .... (2)

Subtracting (2) from (1), we get

$S = D \tan\alpha_2 - D \tan\alpha_1$

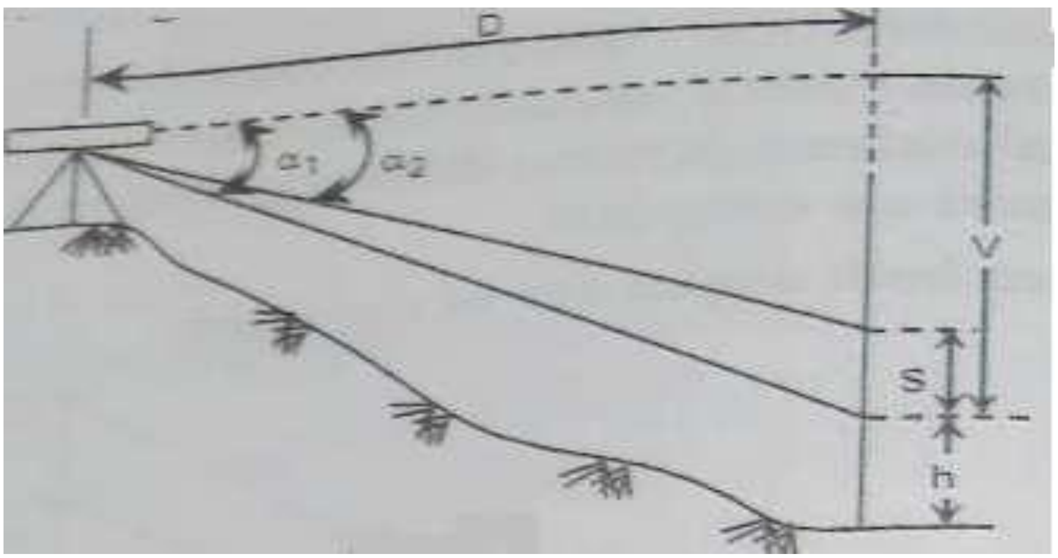
$$D = \frac{S}{\tan\alpha_2 - \tan\alpha_1} = \frac{s\cos\alpha_1 \times \cos\alpha_2}{\sin(\alpha_2 - \alpha_1)}$$

$$V = D\tan\alpha_2 = \frac{S\tan\alpha_2}{\tan\alpha_2 - \tan\alpha_1} = \frac{S\cos\alpha_1 \sin\alpha_2}{\sin(\alpha_2 - \alpha_1)}$$

Elevation of Q = (Elevation of station + h) – V – r

PROCEDURE:

1. Set up the instrument at P and level it accurately by carryout the temporary adjustments.
2. Set vernier reading to zero making line of sight horizontal.
3. Take the first staff reading on Benchmark and determine height of instrument and let it beh.
4. Then sight the telescope towards the staff station whose R.Ls are to be calculated.
5. Measure the angle on vernier if line of sight is inclined upward or downward and also note the three crosshair readings.
6. Determine the R.Ls of various points by calculating the vertical distance



RESULT: The elevation of an inaccessible point is =

CONCLUSION:

Name of the Student:
Registration No. : **Signature of Teacher**

EXPERIMENT – 1(E)

AIM OF THE EXPERIMENT:

To determine the multiplying and additive constant of a given theodolite.

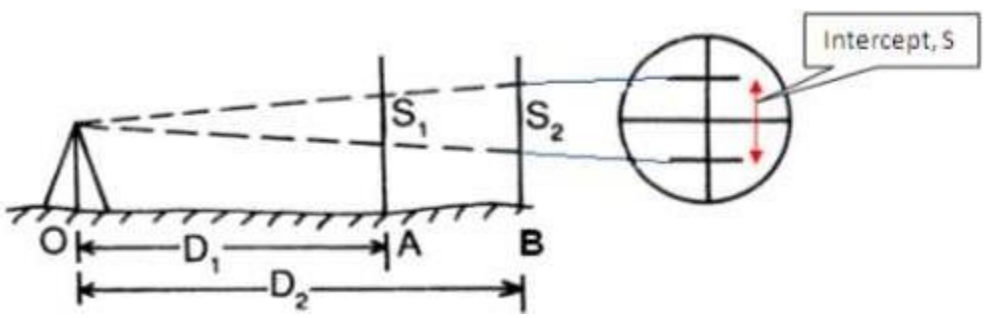
APPARATUS REQUIRED:

Theodolite, tape, ranging rods, levelling staff, arrows etc..

PROCEDURE:

1. Stretch the chain in the field and drive pegs at 10m, 20m interval.
2. Set the theodolite at the zero and do the temporary adjustments.
3. Keep the staff on the pegs and observe the corresponding staff intercepts with horizontal site.
4. Substitute the values of distance (D) and staff intercept (s) for different points in the equation D = ks + C, where k & s are the tacheometric constants. k is the multiplying constant & C is the additive constant.
5. Solve the successive pairs of equations to get the value of k & C and find out the average ofthese values.

OBSERVATIONS AND CALCULATIONS:



Instrument Station	Staff Station	Distance	Stadia Reading			Stadia Intercept (S)
			Top	Middle	Bottom	

$D = KS + C$

$D1 = K.S1 + C$ ....(1)

$D2 = K.S2 + C$ ....(2)

Solve Two Equations & find K & C

RESULT: Multiplying constant, K =

Additive constant, C =

CONCLUSION:

Name of the Student:

Registration No. : **Signature of Teacher**

EXPERIMENT – 2(A)

SETTING OUT CURVES AND SITE SURVEYING:

AIM OF THE EXPERIMENT:

To set out a simple curve RANKINE'S method

APPARATUS REQUIRED: Cross staff, arrows, compass, tape, tripod etc.

FIELD PROCEDURE:

1) Locate P.C. (T_1), P.T (T_2) and P.I. (I).

2) Set up the theodolite exactly at T_1 and make its temporary adjustments.

3) Set up vernier A to zero and bisect the P.I Clamp the lower plate.

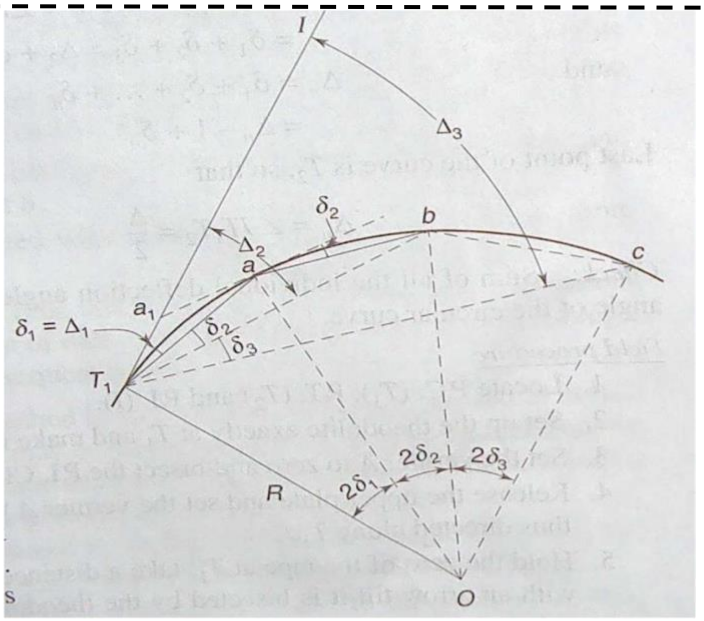
4) Release the upper plate and set the vernier A to read$\Delta 1$. The line of sight is thus directed along T_1a.

5) Hold the zero tape at t_1, take a distance C_1 (T_1a) and swing the tape with an arrow till it isbisected by the theodolite. This establishes the first point in the curve.

6) Set the second deflection angle $\Delta 2$. On the scale so that lime of sight is set along T1b.

7) With zero of the of the tape held at a and an arrow at the other end (chord distance=ab), swing the tape about a, till the arrow is bisected by the theodolite at b, this establishes thesecond point b on the curve.

8) The same steps are repeated till the last point T_2 is reached**.**



CALCULATIONS:

Now, for the first tangential angle δ_1, from the property of a circle

$$\text{Arc } T_1 a = R \times 2\,\delta_1 \text{ radians}$$

Assuming the length of the arc is same as that of its chord, if C_1 is the length of the first chord i.e., chord $T_1\, a$, then

$$\delta_1 = \frac{C_1}{2R} \text{ radians}$$

$$= \frac{180^\circ C_1}{2\pi R} \text{ degree}$$

$$= \frac{180 \times 60 C_1}{2\pi R} \text{ minutes}$$

$$= 1718.9 \frac{C_1}{R} \text{ minutes}$$

(**Note:** the units of measurement of chord and that of the radius of the curve should be same)

Similarly, tangential angles for chords of nominal length, say C,

$$\delta = 1718.9 \frac{C}{R} \text{ minutes}$$

And for last chord of length, say C_n

RESULT: The curve is plotted by using RANKINE'S method.

Name of the Student:

Registration No. : **Signature of Teacher**

EXPERIMENT – 2(B)

AIM OF THE EXPERIMENT:

To set out the foundation marking for the proposed construction of the building.

APPARATUS REQUIRED: Theodolite, tape, ranging rods, strings, arrows etc.

THEORY:

The apparatus of the marking on the side, the centre lines of the foundation of the building is called setting out of a foundation.

PROCEDURE:

1. A centre line sketch of building is prepared.
2. The base line is set out with reference to given reference points.
3. The ends of the centre line of the walls point A and point B from the base line are marked.
4. As the end marks A, B, C etc.. are distributed during excavation stakes are fixed at l, m, n etc., a little away about 2 to 3 m from end mark and accurately using string.
5. The centre line for all the other walls AD, BC etc.. are marked by dropping perpendicular byusing chain or tape 3:4:5 method for an important and big building when sides are long a theodolite may be employed to accurately set out and range the line.
6. For every wall the pegs are driven a little way from the marking end and field accurately with a string.
7. The diagonals are measured and checked with the corresponding calculated lengths.

RESULT: Thus the centre line planned by being marked on the ground.

CONCLUSION:

Name of the Student:
Registration No. : **Signature of Teacher**

EXPERIMENT – 3

STUDY OF MAP AND MAP SERIES

AIM OF THE EXPERIMENT: To study the map and map series

APPARATUS REQUIRED: Physical maps

THEORY:

1. Physical maps:

A physical map of India shows all the physical divisions of the seventh-largest country in the world. The topographical features of the country are quite varied. These high quality and informative maps help you understand all the topographical features of India. The country is home to snow-clad mountains, hills, vast green plains, deserts, forests, rivers, plateaus and seashores. There is no physical feature that you will not find in India.

A physical map of India is always a helpful guide for the students, tutors and parents. They can download this map as a printable or offline version and use it for map pointing purposes. This will help them enhance their knowledge about the physical features of India. With the help of the India physical map, they can easily locate the following areas or physiographic regions in the country:

- The Himalayan Mountain Range (the highest range of mountains in the globe)
- The Indian Peninsula
- The Indo Gangetic Plains
- The Great Indian Thar Desert
- The Western and Eastern Ghat Mountain Ranges
- The Karakoram Mountain Range

This map also highlights the prominent rivers and streams of the country such as the Yamuna, Ganga, Sutlej, Jhelum, Indus and Godavari. The user-friendly map also has a scale which you can use to measure the elevation of the different areas throughout the nation.

A physical map of India shows all the physiographic regions of the nation. In terms of physiography, the country can be listed in the following regions:

- The Islands

- Coastal Plains
- The Peninsular Plateau
- The Great Indian Desert
- Northern Plains or Indo Gangetic Plains
- The Himalayan Mountain Ranges or Northern Mountains

2. Topographic Maps (National Map Series)

A topographic map is a graphic representation to scale, showing horizontal and vertical topographic features of some portion of the earth's surface, systematically plotted on a plane surface.

A national map series is a group of topographic maps usually having the same scale and cartographic specifications, and with each sheet appropriately identified by its publisher.

Map series take place when an area is to be covered is considerably large to represent by a single map sheet due to its scale. In order to overcome this problem area is represented by systematic grid of interlased individual maps known as tiles. But each map sheet (Tile) can be used independently as a full pledge map.

3. Road map:

A road map, route map, or street map is a map that primarily displays roads and transport links rather than natural geographical information. It is a type of navigational map that commonly includes political boundaries and labels, making it also a type of political map. In addition to roads and boundaries, road maps often include points of interest, such as prominent businesses or buildings, tourism sites, parks and recreational facilities, hotels and restaurants, as well as airports and train stations. A road map may also document non-automotive transit routes, although often these are found only on transit maps.

Road maps come in many shapes, sizes and scales. Small, single-page maps may be used to give an overview of a region's major routes and features. Folded maps can offer greater detail covering a large region. Electronic maps typically present a dynamically generated display of a region, with its scale, features, and level of detail specified by the user.

Road maps can also vary in complexity, from a simple schematic map used to show how to get to a single specific destination (such as a business), to a complex electronic map, which may layer together many different types of maps and information – such as a road map plotted over a topographical 3D satellite image

4. Political map:

India is officially known as the Republic of India. It comprises of a total of 28 states along with eight union territories. India is the second most populated country in the world and the world's largest democracy. The country's coastline measures 7,517 kilometres in length, out of which 5,423 kilometres belong to peninsular India, and 2,094 kilometres belong to Andaman, Nicobar and Lakshadweep island chains. Additionally, the Indian naval hydrographic charts along with mainland coastline include 43% of sandy beaches, 36% of mudflats, marshy shores of 10% and rocky shores of 11%.

Broadly, India is divided into six major zones: East India, West India, North India, South India, Northeast India and Central India.

Eastern India includes the states of Bihar, Jharkhand, Odisha, West Bengal and a union territory Andaman and Nicobar Islands. The total population of these states is 226,925,195. The Eastern zone covers a total area of 418,323 sq km Bengali is the dominant language in the state of West Bengal. In contrast, Odia and Hindi are the principal languages in the states of Odisha, Bihar and Jharkhand. English, Maithili, Nepali and Urdu are other languages spoken in Eastern India.

The Western region of India covers a total area of 508, 052 sq km Some of the popular states of western India are Gujarat, Goa and Maharashtra Union Territory of Dadra & Nagar Haveli and Daman & Diu. Mumbai, the financial capital of India, is the capital city of Maharashtra. The states of western India have a prosperous economy with a relatively high standard of living. Official languages of the Western Indian states are Marathi, Gujarati, Konkani and English.

5. Economic & Resources Map

The kinds of Resources Maps of India are co-related with the kinds of natural and created resources available in the country of India. The different natural resources in India include:

- Mineral
- Oil
- Natural Gas
- Power or Energy

Based on the above mentioned resources, the maps on Indian natural resources can be of the following types:

- Mineral Maps of India
- Power or Energy Maps of India
- Oil Maps of India

- Natural Gas Maps of India

Besides these, there are some other Resources Maps of India, which are Agriculture Maps of India, Non-Conventional Energy Maps of India and Water Resource Maps of India. Keeping aside all these types of Resources Maps, on a broader aspect, the Resources Maps of India can be categorized into four following types:

- Agriculture Maps of India
- India Power Maps of India
- Mineral Maps of India
- Non-Conventional Energy Maps of India

6. Climate Map

India experiences a variety of climates ranging from tropical in the south to temperate and alpine in the Himalayan north. The elevated areas receive sustained snowfall during winters. The Himalayas and the Thar Desert strongly influence the climate of the country. The Himalayas work as a barrier to the frigid katabatic winds, which blow down from Central Asia. The Tropic of Cancer passes through the middle of the country, and this makes its climate more tropical. India is a big tropical country and is famous for its diverse climatic features.

Different Types of Climatic Regions

The climates of India are mainly divided into four different groups. The classification of these groups is based on the Koppen climate classification system.

Tropical Wet (Humid): The tropical wet (humid) climate group in India is divided into two subparts - tropical monsoon climate or the tropical wet climate, and tropical wet and dry climate or savannah climate. The Western Ghats, the Malabar Coast, southern Assam, Lakshadweep and Andaman and the Nicobar Islands have the tropical monsoon climate. It experiences moderate to high temperature with seasonal but heavy rainfall. The months from May to November experience the most rainfall and the rain received during this period is sufficient for vegetation throughout the year. Tropical wet and dry climate or the savannah climate is most common in the country. It prevails mainly in the inland peninsular region of the country except for some portion of the Western Ghats. The summers are scorching and the rainy season extends from June to September.

Tropical Dry: The tropical dry climate group is divided into three subdivisions (a) tropical semi-arid (steppe) climate, (b) sub-tropical arid (desert) climate and (c) sub-tropical semi-arid (steppe) climate. Karnataka, central Maharashtra, some parts of Tamil Nadu and Andhra Pradesh experience the tropical semi-arid (steppe) climate. Rainfall is very unreliable in this type of climate, and the hot and dry summers are experienced from March to May. With scanty and erratic rainfall and extreme summers, western Rajasthan witnesses the sub-tropical arid (desert) climate. The areas of the tropical desert that runs from the regions of Punjab and Haryana to Kathiawar witness the sub-tropical semi-arid (steppe) climate. The maximum temperature in summers goes up to 40°C, and the rains are unreliable and generally take place during summer monsoon season in this climate.

Sub-tropical Humid Climate: This climate is witnessed by most of the North and Northeast India. Summers are scorching, while in winters, the temperature can plunge to as low as 0°C. Rainfall mainly occurs in summers, but snowfall or occasional rain in winters is also witnessed in some areas. The hottest months are May, and June and frost also occur for few months in winters.

Mountain Climate: The temperature falls by 0.6°C for every 100 m rise in altitude in the Himalayas and results in several different climates from tropical to tundra. The trans-Himalayan belt, which is the northern side of the western Himalayas, is cold, arid and windswept. There is less rain on the leeward side of the mountains whereas the well-exposed slopes receive heavy rainfall. The heaviest snowfall occurs between December to February.

7. Thematic maps:

Preparation of thematic maps based on interpretation of aerial photographs is an important activity of FSI. Aerial photographs procured from Survey of India are interpreted using stereoscopes. After intensive ground verification corrections are incorporated in the interpreted aerial photographs. These photographs are sent to the SOI for transference of the interpreted details on base maps on 1:50,000 scale and for preparation of thematic maps. Thematic maps depict forest types, major species composition, crown density of forest cover and other land uses. They depict as many as 48 forest types and 14 other categories of land uses. Thematic map are one of the best forest type map available in FSI. These maps are used by various State Forest Departments for updating stock maps, working plan preparations, management of forest resources and land use planning. These are also indented by Railways, Engineering, Educational, Mining and other establishments for their general planning and programme execution.

The total geographic area of the country is covered by 5,200 SOI map sheets on 1:50,000 scale. Of these about 3,400 sheets bear forest cover. Each year about 5,200 aerial photographs corresponding to 260 SOI sheets on 1:50,000 scale were interpreted for generation of thematic maps. About 75% of the forested area of the country has been covered by thematic mapping.

8. Open Series map and Defense Series Map

Defence Series Maps (DSMs) - These topographical maps (on Everest/WGS-84 Datum and Polyconic/UTM Projection) are on various scales (with heights, contours and full content without dilution of accuracy). These maps mainly cater for defence and national security requirements. This series of maps (in analogue or digital forms) for the entire country are classified by the Ministry of Defence.

Open Series Maps (OSMs) - OSMs are brought out exclusively by SOI, primarily for supporting development activities in the country. OSMs bear different map sheet numbers and are in UTM Projection on WGS-84 datum. Each of these OSMs (in both hard copy and digital form) become 'Unrestricted'.

RESULT:

CONCLUSION: The study of maps of different condition of the country has been studied and analysis for future reference.

Name of the Student:
Registration No. : **Signature of Teacher**

EXPERIMENT NO – 4

STUDY ON GPS & DGPS AND ETS

AIM OF THE EXPERIMENT: Study of GPS & DGPS and ETS

APPARATUS REQUIRED: GPS and DGPS and ETS related equipments

GPS:

GPS, which stands for Global Positioning System,is the only system today able to show you your exact position on the Earth anytime, in any weather, anywhere.

Typical Recreational Grade GPS units

Applications of GPS

- Providing Geodetic Control
- Photogrammetry
- Finding out location of offshore drilling
- Pipe line and power line survey
- Navigation of civilian ships and planes
- Crustal movement studies

The History of GPS

- Feasibility studies begun in 1960
- Pentagon appropriates funding in 1973.
- First satellite launched in 1978.
- System declared fully operational in April,1995.

Measurement of GPS Satellites Signals and position determination

Measurement of Travel time of the signals from a constellation of GPS Satellites orbiting the earth forenabling the position in the earth. The GPS satellites are in orbits such that one can be able to receive signals from at least four satellites to enable for the determination of latitude, longitude, altitude and time.

Calculating Distance

Velocity × Time = Distance

Radio waves travel at the speed of light, roughly 186,000miles per second (mps)

If it took 0.06 seconds to receive a signal transmitted by a satellite floating directly overhead, use this formula to find your distancefrom the satellite.

186,000 mps **x 0.06** seconds **= 11,160 miles**

POSITION CONCEPTS OF GPS

- Latitude
- Longitude
- Altitude

GPS service and civilian users

- Available of basic GPS service to civilian userswith an accuracy of 100 meters.
- Removal of selective availability to improvethe accuracy of a few meters

Satellite Transmission signals

L1 Carrier signals 154 × 10.23 M Hz =1575.42MHz (Wave length 19.05 cm)

L 2 Carrier signals 120 × 10.23 M Hz =1227.60MHz (Wave length 24.45cm)

Sources of GPS signal errors

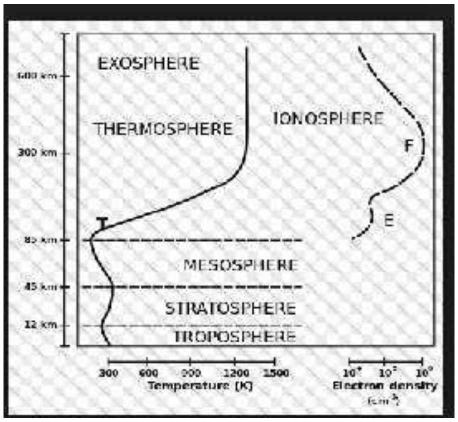
Factors that can affect the GPS signal and thus affectaccuracy includes as follows :

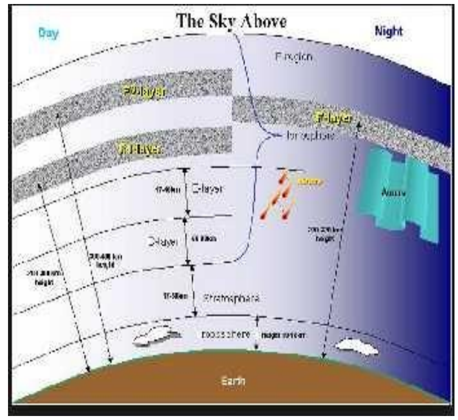
- Ionospheric and Troposphere Delays
- Signal Multipath
- Receiver clock Errors
- Orbital errors/ Ephemeris errors
- Satellite Geometry / Shading

Sources of GPS signal errors

Ionospheric and Troposphere delays :

The satellite signal slows as it passes through the atmosphere. The GPS system uses a ‘built in model' that calculates an average amount of delay to partially correctfor this type of error.





Signal Multipath

This occurs when the GPS signal is reflected off objects such as tall buildings ,large rock surfaces etc. before it reaches the receiver. This increases the travel time of the signal thereby causing errors.

Receiver Clock Errors

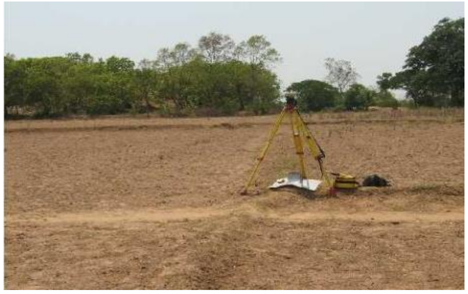
A receiver's built –in clock is not as accurate as the atomic clocks on board the GPS satellites. Therefore, it may have very slight timing errors.

Orbital Errors

Also known as ephemeris errors.These are inaccuracies of the satellite reported location.

DGPS:

Differential GPS(DGPS) is a system in which differences between observed and computedco-ordinates ranges(known as differential corrections) at a particular known point are transmitted to users(GPS receivers at other points) to upgrade the accuracy of the users receivers position.

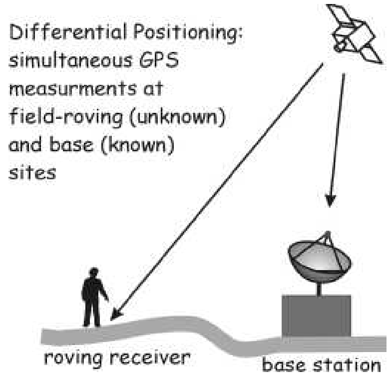


Differential GPS Positioning

Differential positioning user finds the point position derived from the satellite signals and applies correction to that position. These corrections, difference of the determined position and the known position are generated by a Reference Receiver ,whoseposition is known and is fed to the instrument and are used by the second Receiver to correct its internally generated position.This is known asDifferential GPS positioning.

Differential Correction

Differential correction is a technique that greatly increases the accuracy of thecollected DGPS data. It involves using a receiver at aknown location - the "base station“- and comparing thatdata with DGPS positions collected from unknown locations with "roving receivers."



Geodetic/ High Precision Applications

- To use the carrier phase as observables
- To use both the frequencies(L1,L_2)
- To have access to the P-code (For long distances and geographical regions with strong ionospheric disturbances)

Electronic Total Station (ETS):

The total station is an electronic/optical instrument used inmodern surveying. The total station is an electronic theodolite integrated with anelectronic distance meter (EDM) to read slope distances fromthe instrument to a particular point.

Distance Measuring (Electronic Distance Meters)

In the early 1950's the first Electronic Distance Measuring (EDM) equipment were developed. Primarily consisted of electro-optical (light waves) and electromagnetic (microwave) instruments. Bulky, heavy and expensive. The typical EDM today uses the electro-optical principle. They are small, reasonably light weight, highly accurate, but still expensive.

Name of the Student:

Registration No. : **Signature of Teacher**