SB 25/09/23

EWCE 203 — Surveying

Syllabus

1. Fundamentals
2. Linear Measurements
3. Chain Surveys
4. Traverse "
   Plan Table survey
5. Photogammetry Surveying
6. Astronomical "
7. GIS, GPS, & RS
8. Project Survey

References

1. Surveying - Vol I, II, III by BC Punmia
2. A Text Book of Survey by MA Aziz and M Shahjahan.

Eye sketch, map / plan

RS - Remote sensing

GIS - Global Information System

1. Survey: to look at closely or examine something by someone.

2. Surveying: work of examining and recording the areas & features of a piece of land & represent on a piece of paper, called map or plan.

Map & plan: larger area for map; scale 1 cm = 10000m
smaller " " plan; 1 cm = 10 m

Areas where surveying are used

1. Map of the country
2. Prepare navigational map
3. Establish boundry
4. Data map | Legends: 🌲 → date tree

* Methods of surveying:

1. Geodetic Survey
2. Plane "

* # When to decide which methods to follow:

1. Characteristics of survey
2. Magnitude of survey
3. Precision of survey

* Classification of survey based on the field of survey

1. Land survey
   a. Topo survey
   b. Cadastral survey
   c. City survey
2. Marine Survey
3. Astronomical survey

SB 02/10/23

Geodatic survey

Datum → Reference height

Defined → USGS

WGS & 21

—

SOB → Survey of Bangladesh; responsible for determining Datum.

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Street road, highway, national highway

End of prev class nev.

1. Survey definition

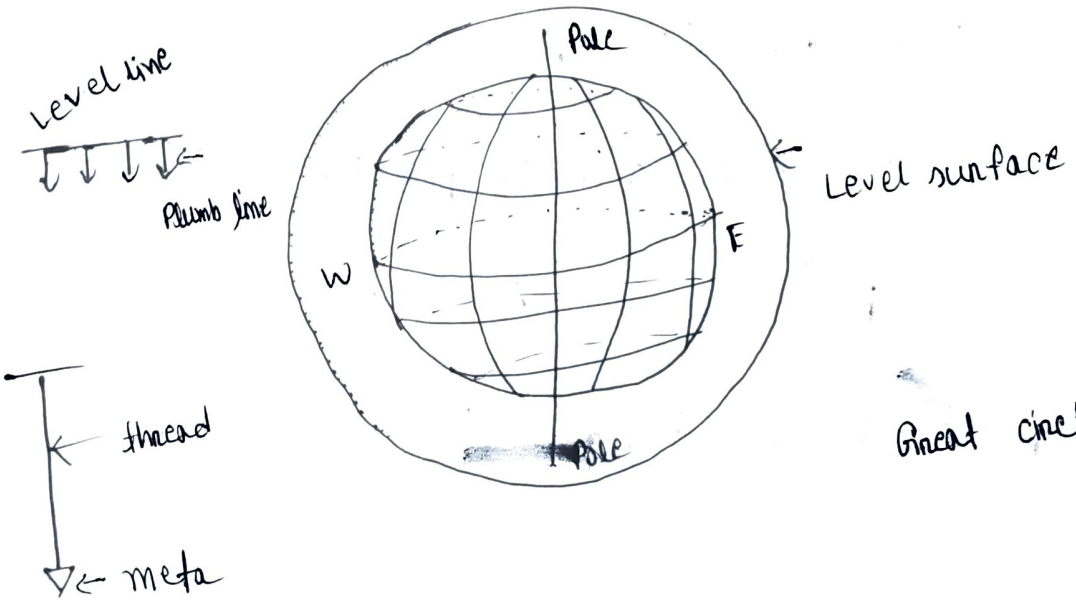
2. Surveyor

3. Levelling

4. Purposes of survey

5. Terms: curved surved surface, level surface, level, line

Oblate, / sphere



highest building
high rise / skyscrapper

1. Surveying: Art & Science of determining relative positions of points by means of measurement of distance, direction & elevation presenting on a piece of paper.

2. Purposes:

i. Def^{n} the relatieve posn.

ii. Layout of marked position

iii. Def^{n} are, vol, & others

iv. Prepare map.

Next class: basic principal of survey

SB 09/10/23

To be discussed

1. Scale of Map / plan
   - Definition
   - Methods of representation of scale
   - Choice of scale while ~~planning~~ plotting
   - Types of scale

2. Mathematical Problems

Defⁿ of scale:

Fixed ratio : that every distance on map/plan bears the corresponding distances on the ground.

Methods of reps of scales:

1. Numerical scale
   a. Engineers' Scale — 1 cm = 10 m
      = 100 m
      = Multiple of 10

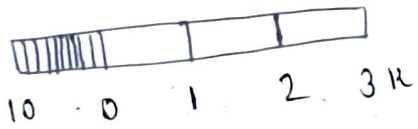
b. Representative Fraction (R.F) scale

1 cm = 10 m

= 1000 cm

1/100 → 1 : 1000

2. Graphical scale



Choice of scale:

1 Most common scale is 1cm = 10m

= multiple of 10

2. Primary considerations:

a. Use of map/plan

b. Extent of territory to be represented

3. Generale rules

- pick such scale so that $\frac{1}{64}$" or 0.25 mm is not ~~have~~ to be put.

- important points can't be drawn

Types of scale

1. Plain scale

(see fig from slide/lec doc)

2. Diagonal scale

(see fig ...)

3. Vernier scale

Used in — 1. Theodolite

2. Sextant

3. Clinometer

4. Total station

The area of the plan of a old survey plotted to a scale of 10 m to 1 cm. measures now 100.2 sqcm., as found by planimeter.

The plan is found to be shrunk so that a line originally 10 cm long measures 9.7 cm. only. Find the shrink scale & True area of survey

—

~~scale~~:

Original: 1 cm – on map 10 m on ground

$$RF = \frac{1}{1000}$$

Actual	Now
10 cm	9.7 cm

$$SF = \frac{9.7}{10} = 0.97$$

Shrink scale = Original scale × SF

$$= \frac{1}{1000} \times 0.97$$

$$= \frac{1}{1000/0.97}$$

$$= 1 : 1030$$

$9.7 \longrightarrow 10$

$100.2 \longrightarrow \frac{10}{9.7} \times 100.2 = 103.3$ sq cm

Now,

1 cm = 10 m

1 sq cm = 10×10 sq m

True area = $103.3 \times (10)^2$ sq. m

= 10330 sq. m.

---

30 × 20 = 600 sq cm on drawn
600 × (100)²
= 6000000 sq m
= 600 hect

A rectangular plot of land measures 30 cm × 20 cm on a village map, drawn to a scale of 100 m to 1 cm. Calc area in hectors. If the plot is redrawn to a topo sheet to a scale of 1km to 1cm, what will be the area on topo sheet.
Also defn the RF of village map & topo sheet

Submit by next class

single page

SB 10/10/23

To be discussed

1. Basic principles of survey
2. works of a surveyor
3. Govt. organizations for surveying
4. Khatian / Poncha / Sottolipi

3→ ভূমি, রেকর্ড ও ভূমি অফিসের

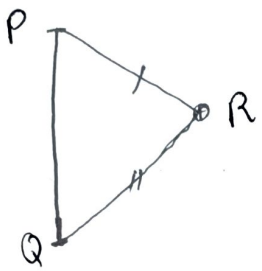
Survey of Bangladesh

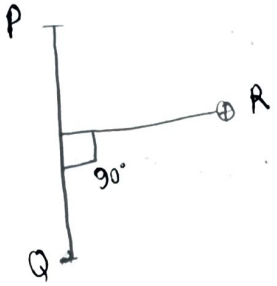
Geological Survey of Bangladesh

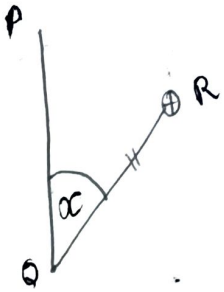
4→

1. Basic principles of Survey

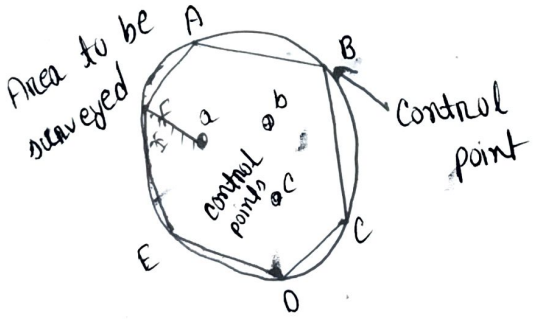
a. To locate a position from two reference points.







b. work from whole to parts



2. Works of surveyors

a. Field works

b. Office works

c. Care & maintenance of instruments

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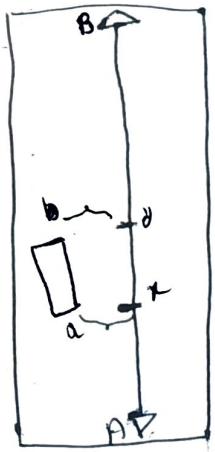
a → Measurements

Record in Field Book

a. Numerical values

b. Sketches

c. Explanatory notes



b → Prep of plan & sections

Computation

Design

Plot

(→ why ??

Calibration: Process of determining the accuracy of the equipment in measured results.

Process of calibration:

1. obtain reading
2. measure the variation
3. then adjust

Requirements

Precautionary measures - General:

In landing instruments

1. Lifted
2. Carry
3. Telescope to be capped over lens when not in use.
4. Do not set on smuth floor.

5. When not use, use water proof / dust cover.

6. Do not leave unguarded

7. Do not force any screw.

8. Compass when not in use, lift off needle.

** From salt-water ~~equipment~~ environment

watch oil

Camel's hair brush

Linen cloth

3. Govt. organizations

i. Land records & survey dept.

ii. SOB → Geodetic survey

Photogrametic "

Cartographic survey

Map "

iii. GSB

a. Investigation & exploration of mineral resources

b. Geo & Investigation

c. Engineering hazard studies

d. Urban geological mapping

4. Khatian

i. Persian word

ii. Document for identifying ~~no~~ land

iii. Only records of land

Content

Rule: Bengal Tenancy rule 1885

Plot no.

Name

Oth...

Mutation Khatian : Registration /

Types :

CS Khatian (Cadas Survey) 1888 - 1940 (52yrs)

RS " (Revisional Survey) -> update amount of land ownership & possession

not much authentic → SA/PS " (State acquision/settlement attestation/ Pakistan survey)

BS " (Bangladesh Survey)

1 Khata = 720 sq ft

= 1.65 decimal

1 decimal = 435.6 sq ft

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16/10/23

EWCE 103 : Surveying

Precision, Accuracy and Errors

1. How to achieve accuracy?
2. Important functions doing survey
3. Discrepancy & Error
4. Sources of Errors
5. Types " "
6. Permissible errors
7. Limitation to precise work

ASTM
American Standard of Testing materials

1. Precision: Degree of perfection used in instruments methods & observations.

2. Accuracy: Degree of perfection achives.

Accuracy depends on: Instruments
methods
planning

Sources of errors

1. Instrumental error
   - Parallax error
   - Staff graduation error
   - ~~Loose fitting~~ Loose fitting
2. ~~Personal error~~ Personal errors
3. Natural error

Classification of errors:

1. Mistake
2. Systematic error
3. Accidental error

Permissible errors:

1. Scale
2. Purpose of survey
3. Instruments used

Limitation of Surveyors for Precise Works:

1. Rough Terrain
2. Too small time
3. Small survey team
4. Poor instrument
5. Bad weather

Rough / CT 1

Scale: Fixed ratio, ~~on~~ that every distance on the map / plan ~~or~~ bears with the corresponding distance on the ground.

#1. Given, 1cm on the plan = 10m on the ground

$\therefore$ RF = 1 : 1000

10 cm shrunk to 9.7 cm

$\therefore$ S.F. = $\frac{9.7}{10}$ = 0.97

RF of shrunk scale = $\frac{1}{1000} \times \frac{9.7}{10}$

= 1 : 1030

9.7 ⟶ 10

100.2 → 103.3 sq cm

= 103.3×10^2 sq m

= ...

1cm = 10 m

$1 sq cm = 10^2 m^2$

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23/10/23

Linear Measurement

1. Direct Measurement — measurement of length
2. Chaining — measurement by chain or tape (Invar tape)
3. Ranging — fixing intermediate position
4. Errors in chaining

Direct measurement

- - -
- - -
- - -

Adjustment of chain

Ranging

Direct

Indirect

SB

02/11/23

Linear measurements

Chain

Metric chain

S.I. units →

Guntar's chain

66 feet

Engineer chain

100 feet

Revenue chain

in cadastral survey

... feet

Steel band

narrow strip of blue steel → Chemical coating on carbon chai

skip- P10

Adjustment on chain

—

Measuring tape

Invar tape

low coefficient of thermal expansion

—

Ranging

—

Direct ranging

Indirect or reciprocal ranging

—

Chaining on uneven slopping ground

Indirect method for regular on even slope

—

Method 3: Hypotenusal allowance

!★★ Errors in chaining

★★ Personal mistakes

SB 06/11/23

Field book

☆☆ defⁿ

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Chain survey

Procedure:

i) Field work

Reconnaissance

Marking & fixing survey stations

Running survey lines

ii) Keeping records of data

iii) Plotting data

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1) Reconnaissance:

Things to do:

a) General arrangement of lines & survey stations.

b) Mark principle features — roads, buildings...

c) Examine inter-visibility of stations.

d) " difficulties that may arrive.

SB 07/12/23

1. scale of vertical photos; $< 3^\circ$; $S_h = \frac{f}{H-h} = \frac{f}{H}$

2. Relief displacement

$$d = \frac{rh}{H}$$

$$= \frac{r_0 h}{H-h}$$

3. Conditions for preparation of map from vertical photos.

(i)

(ii)

(iii)

4. No. of photos of an area

$N = \frac{A}{a}$ → area of ground

$a = L * W$

↳ net ground len corresponding to l.

$N = \frac{A}{a}$

$L = (1 - p_0) s * l$ → % of forward overlap = 60%

$p_0 = 0.6$

s = scale $\frac{f}{H}$

$W = (1 - p_w) s * W$

↳ % of side overlap

5

Distortions of vertical aerial photos due to flight

a. crab → ঁকাভ হইয়া চলা — Angle foamed with edges of photos with flight.

b. ~~Drift~~ Drift

Area = 100 kms = A

l = 20 cm

w = 20 cm

P_1 = 60 %

P_2 = 30%

scale : 1cm = 100 m

$$N = \frac{A}{a}$$

$$= \frac{100}{0.8 * 4}$$

$$\simeq 90$$

a = L * W

= 0.8 * 4

= .

L = (1 - P_1) * l

= (1 - 0.6) * 100 * 20

= 0.8 km

W = (1 - 0.3) * 100 * 20

= 1.4 km

SB 11/12/23

Drone Survey

1. Defn
2. Benefits — Reduce field time
   Provide accurate and exhaustic data
   Map the inaccessible area
3. Purposes —
   a. Land survey & cartography
   b. Land dev & management
   c. DSM - Digital surface model
   d. DTM/DEM - Digital Terrain/Elevation
   e. Precise measurement
   d. Slope monitoring
   f. Contour lines
4. Deliverables — a. Orthomosaic map
   b. 3D Point cloud

Advantages
a. Ease of use
b. Simple equipments
c. Effortless path

d. Superior Ground Survey

e Highly accurate

f. Affordable

g. Evolved technology

h. complete task - expeditiously

Nos of photos:

$N = N_1 * N_2$; N_1 = Nos of photos in each strip

~~$\frac{L_1}{L}(1-Pl)Sl+1$~~ ; L - net covered area of each photo on ground

$\frac{L_1}{(1-Pl)Sl}+1$;

P: % of longitudinal overlap

N_2 = Nos of strips / flight line

$\frac{L_2}{(1-Pw)Sl}+1$;

$L = (1-Pl)Sl$ → photos length; 55-65% → 60% → scale, 1cm = 100 m

$N_1 = \left(\frac{L_1}{L}+1\right)$

$N_2 = \left(\frac{L_2}{w}+1\right)$

$p_l = 60\%$

$p_w = 30\%$
(aka P_s)

$L = 10\ km$

$W = 10\ km$

$l = 20\ cm$

$w = 20\ cm$

$$N_1 = \frac{L_1}{L} + 1$$

$$= \frac{100 * 1000}{800} + 1 = 135 \simeq 14$$

$$N_2 = \frac{10 * 1000}{1400} + 1 = 8$$

$$N = N_1 * N_2 = 112$$

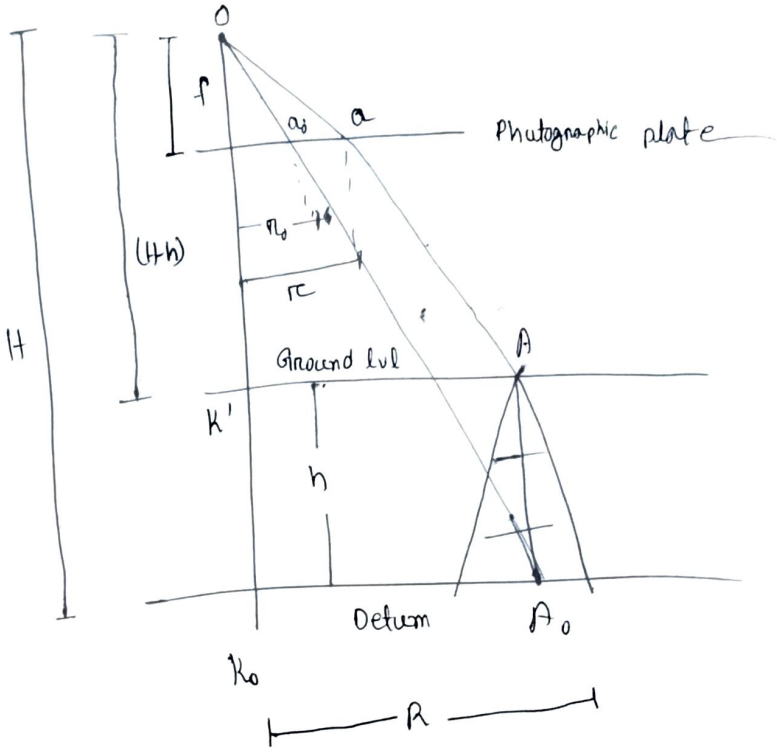
$$N = \frac{A}{a} = \frac{100\ sq\ km}{L * w}$$

$$= 90$$

Relieve displacement

$$d = \frac{rh}{H}$$

$$= \frac{r_0 h}{H-h}$$



$\Delta OKa \sim \Delta OK'A$

$$\frac{OK}{OK'} = \frac{Ka}{K'A}$$

$$\Rightarrow \frac{f}{H-h} = \frac{r}{R}$$

$$\Rightarrow R = \frac{r(H-h)}{f}$$

$$\Rightarrow r = \frac{Rf}{H-h}$$

$$r_0 = \frac{Rf}{H}$$

$$d = r - r_0$$

$$= \frac{Rf}{H-h} - \frac{Rf}{H}$$

$$= \frac{R+h}{H(H-h)}$$

$$= \frac{fh}{H(H-h)} \times \frac{r(H-h)}{f}$$

$$\therefore \frac{rh}{H}$$

Given,

datum scale, $S_d = \frac{1}{10,000}$

$d = ?$

$f = 20\ cm$

$h = 250\ m$

$r = 6.44\ cm$

$\therefore \frac{rh}{H}$

$= \frac{6.44 \times 2500}{2000}$

$= 0.8\ cm$

$S = \frac{f}{H} = \frac{1}{10000}$

$= \frac{20\ cm}{H\ m} = \frac{1}{10000}$

$\therefore H = 2000\ m$

SB 14/12/23

Astronomical ~~Science~~ Survey

1. Astronomy
2. Astronomical Survey
3. Importances
4. Important terms
   a. Earth's and celestial sphere
   b. NP, SP, CNP, CSP
   c. Tropic of cancer's capricorn
   d. Great circle
   e. Equator
   f. meridians

Br of science which deals with celestial body, space, and physical universe.

Absolute location

SB

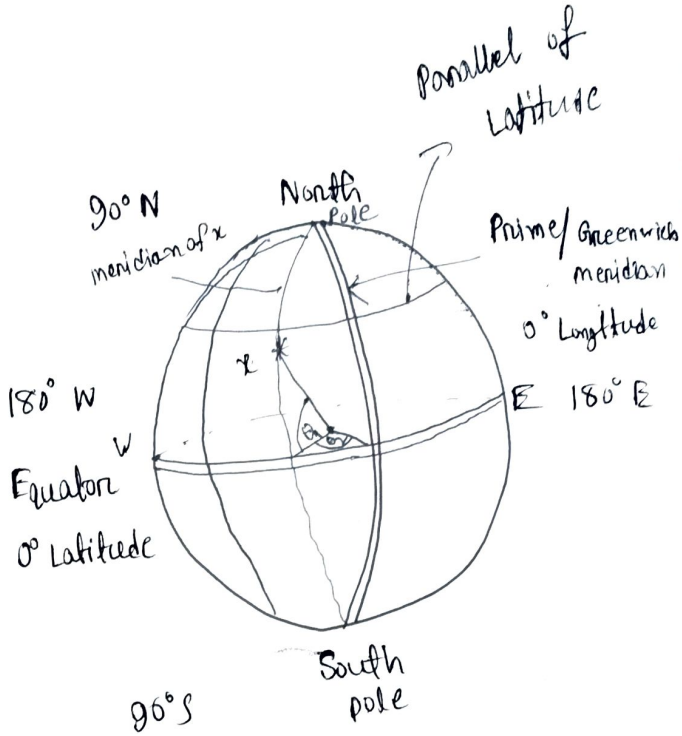
18/12/23

Astronomical Survey

1. Location of pos 'x' on the earth's surface

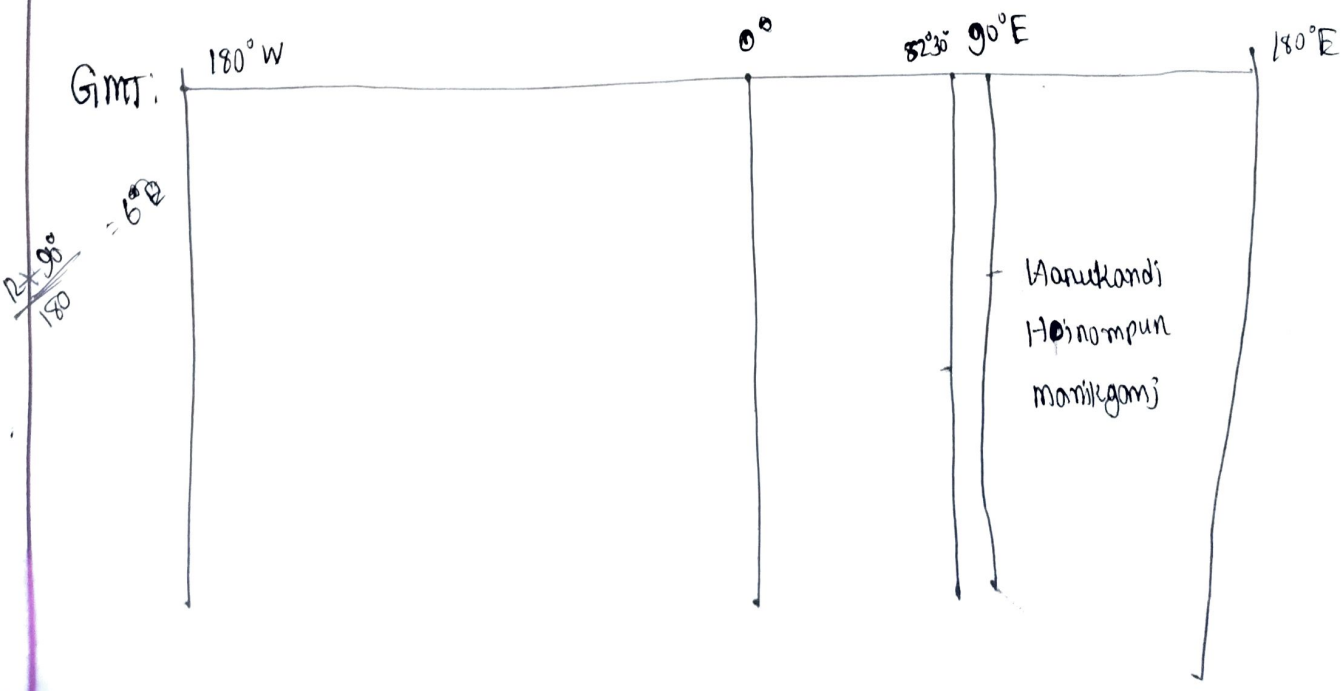
Lat: θ_1° N
$\theta_1^\circ 0' 0''$ N

Long: θ_2° E
$\theta_2^\circ 0' 0''$ E



2. meridian are important in setting time zone

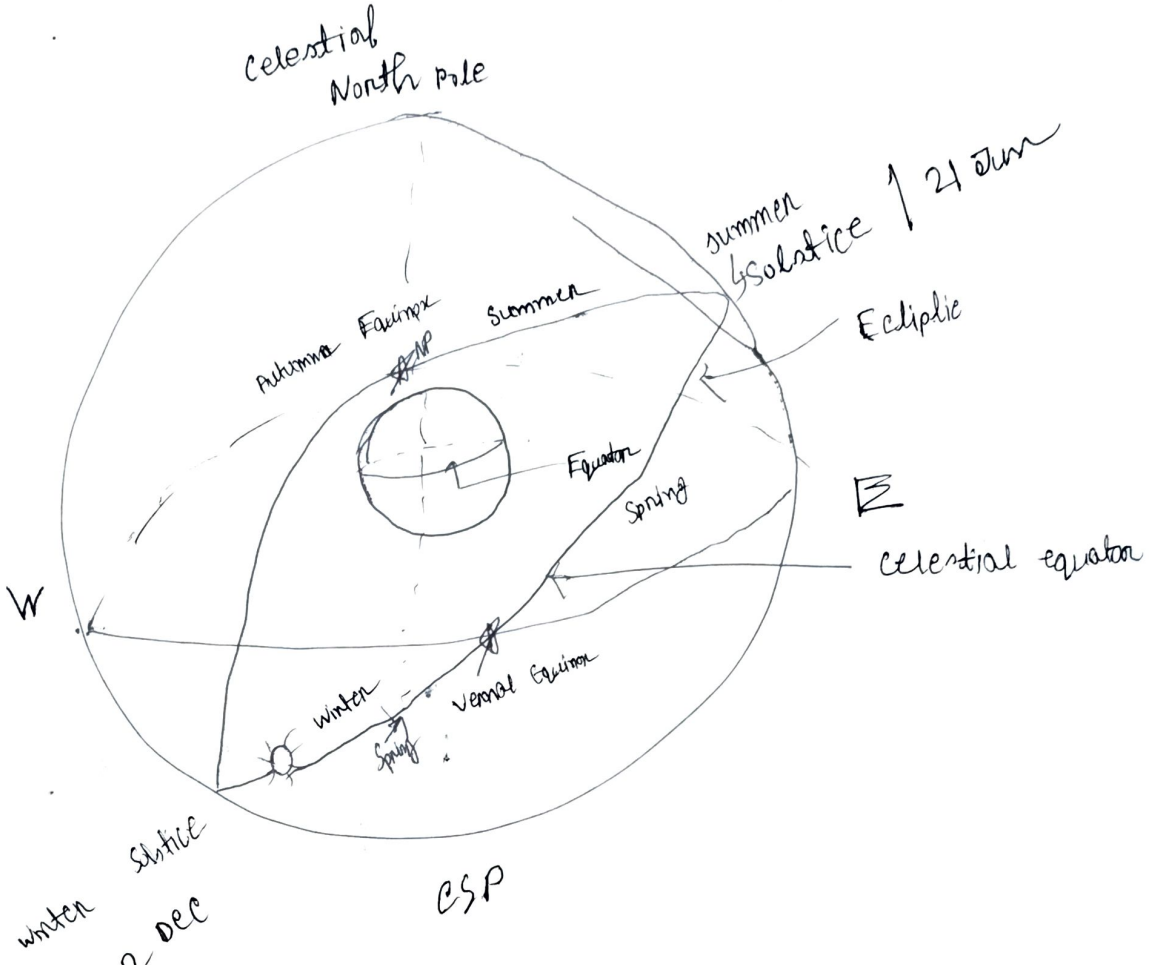
Royal Observatory
Greenwich



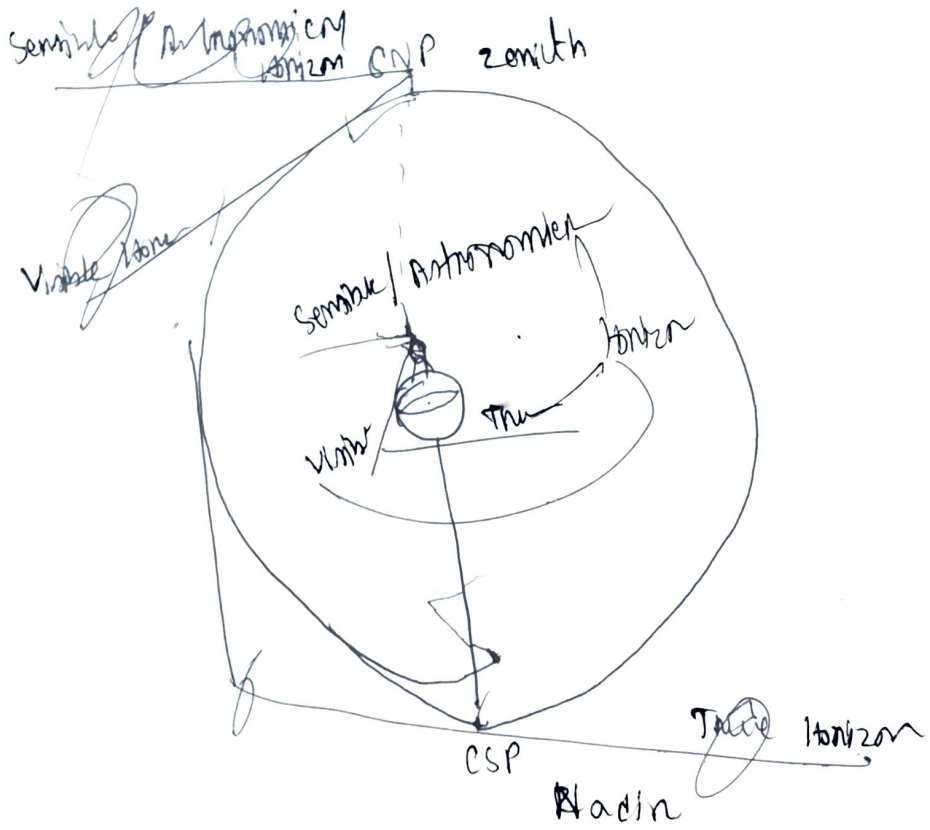
$\frac{82.5^\circ}{180} \times 90^\circ = 6^{hr}$

3. Celestial Sphere

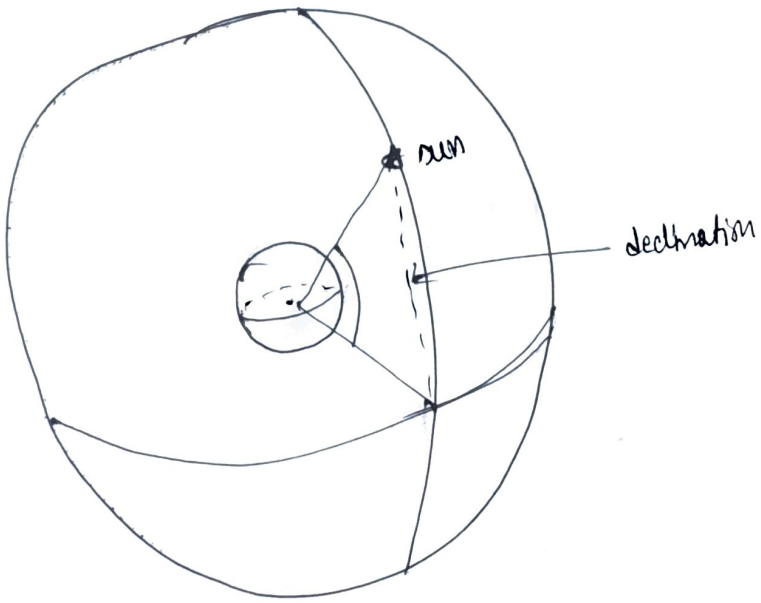
~~Diff~~:



4. Zenith, Nadir, Horizon



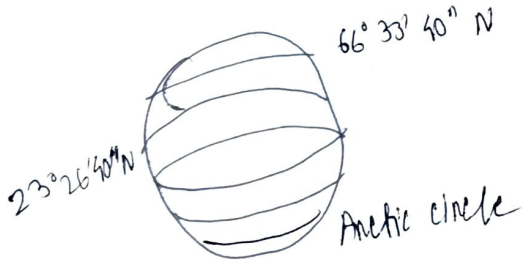
5. Azimuth, Altitude's Declination



6. Hour angle & Hour circle



7. Zones of the Earth



SB/EWCE 103

21/12/23

1. What is GIS
2. GIS data
3. Linking of data in handling geographical information.
4. Types of vector data
5. Common
6. Benefits
7. Areas in application

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2. GIS data → special data, non-special data

GIS Functions

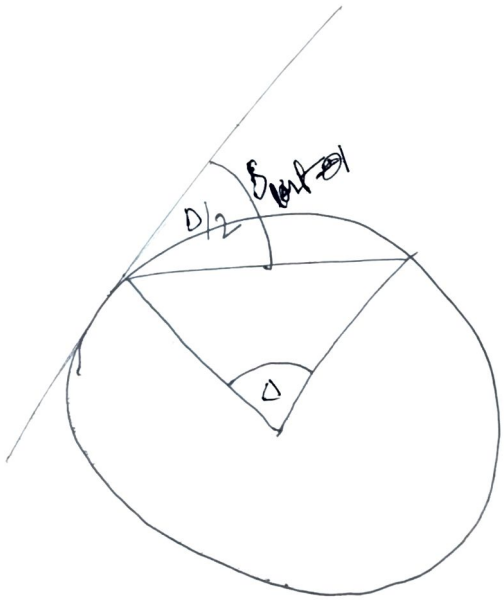
Capture → store → analyze → query → display → output

TIN Region

Dynamic N segmentation

By Rankine's method

Check



SA 26/12/23

Transition curve

may be,

True spinal

Cubic spinal

Cubic parabola

$$\frac{p}{w} = \frac{\tan\theta + f}{1 - f\tan\theta} \qquad \frac{v^2}{gR} = \frac{p}{w} = \frac{e}{B} =$$

Prob 3.1: $\frac{e}{B} = \frac{v^2}{gR}$; $L = \frac{\alpha e v^3}{R}$

Prob 3.2:

a)

b) $L = \frac{\pi R D_c}{180}$; $D_c = D - 2D_s$; $D_s = \frac{L}{2R}$

SB 28/12/23

GPS

Global Positioning System

Satellite Navigation System

↳ Objects in space orbit around a bigger object

Astronauts → rest of the world

Cosmonauts → Russian team

GLONASS → pronounce: glonas → Global Navigation Satallite System (Russia)

BNASS (China)

EUGPS

QZSS

GPS — Satellites (USA)

24 satellites
6 orbits
each has 4 satellites

Basic Structure of GPS

- Space segment
- Ground "
- GPS Devices

Primary Service Area

Secondary service area

How GPS work?

Methods of GPS measurements by surveyor

a) RTK positioning
   ↳ Real time kinematic

3) CORS

Bangabandhu Satellite

SB

01/01/23

Remote sensing system (RS System)

Rough / CT-3

GIS: Geographical Information System

Capture, store, analyze, manage, and presents data linked to a location.

Functions: capture → store - analyze → query → display → output

Data: Spatial → directly / indirectly refenenced to a location on Earth's surface

Non-spatial → can't be related to a location on Ea...

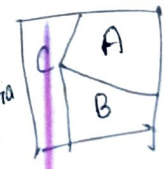
Discrete feature: Has definite boundary and indentify - house

Continuous feature: No " " on " ; instead transition from one value to another - elevation

Vector model: Represents discreate feature through point, line, polygons

Raster data model: Reps cont. feature by grid of pixels.

Attribute data: Additional infon for control chart



Linking data to real world:

Geographic coordinat system : X°Y'Z" N I°J'K" E

Geo-referencing : map to geographic coor. sys.

Geo-coding : Input text to geographic coor. sys.

Vectors:

Simple vector data: consists of point, lines, polygons

Higher lvl vector data:

TIN (Triangulated irregular network) : set of non-overlapping triangles

Region: collection of polygons

Dynamic segmentation: process of, transforming linearly referenced data (from table) into features on map

1- Q1e, Q4d 2- Q3c, Q4c

Probs on handling geospatial info:

- poorly maintained
- out of date
- inaccurate
- no data retrival service
- no data sharing

Benefits of GIS implementation

- better maintained
- easier to update
- search, analyze, represent
- more value adde products
- shared & exchanged freely
- time & money saved
- better decision

GPS: Global Positioning System

A satellite nav system

Basic structure: three segments

i) Space segment: GPS satellites, 24 in count in 6 orbits, 4 per orbit, at an altitude of 19400 km, at v = 11200 kmph. Emites nav signals continuously.

ii) Control segment: Ensure sats are in orbit and GPS timings are within tolerate lvl.

E.g. Sajeeb wazed Ground station at Gazipur for Bongabandhu satellite-1.

iii) User segment: receivers; mobile, car, watches ....

Bangabandhu Satellite-1:

- First communication & broadcasting sat of Bangladesh
- Manufactured by Thales Alenia Space of Franch
- Launched from Kennedy Space center by spacex on Falcon 9 v12 rocket.
- Operated by Bangladesh Communication Sattelite Company Limited
- Mission duration of 15 years.
- PSA are Bangladesh & neighbouring countries
- SSA are South East Asia, Middle East, North Africa, East Africa, Europe.
- Being used by various media org.
- Primary ground station at Gazipur
- Secondary " " " Rangamati as well as 2 in Indonesia & Philippines.

SB

04/01/23

Project survey

1. Defⁿ – all works and calculation with maps, profiles & other drawings involve in planning and construction of engg projects.

2. Steps:

a. Plan the survey

b. Design pilot survey & comm.

c. Get response

d. Analyze result & dev recommendation

e. Make decision & act

3. Different type of survey

a. Boundary survey

b. Topo survey

c. Contour "

d. Levelling "

e. Construction "

f. As-buit survey

g. Bathymathie "

1. Reconaissence survey

2. Preliminary survey — instrumentation survey

3. Final survey

4. As-built / ~~su~~ construction survey

House setting:

1. N-line fixed

2. Corner fixed