FINAL TERM EXAM

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SECTION: B

Paper :- Advanced Engg Surveying

Department: Civil Engineering

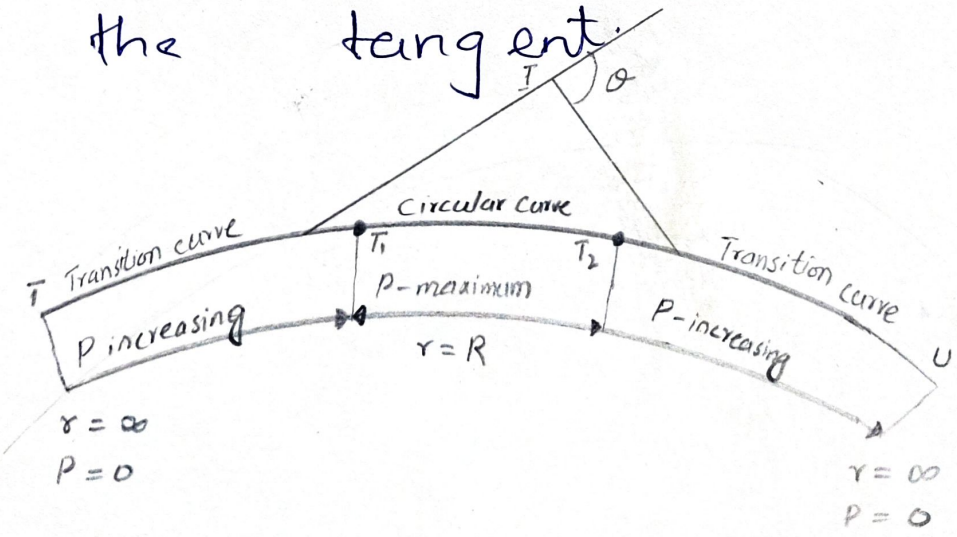
Q: No: 01 (C-3) ①

Transition Curves:-

A curve of varying radius is called transition curve.

It is also called Spiral Curve or Easement Curve.

It is used on both highways & railways between. tangent & circular curve in order to have smooth transition from tangent to the curve & from curve to the tangent.



Super Elevation:

"It is the transverse slope provided at horizontal curve to counteract the centrifugal force, by raising the outer edge of pavement w.r.t inner edge. throughout the Length of horizontal curve.

Mathematical equation:

$$e = \frac{V^2}{gR}$$

Effected by:

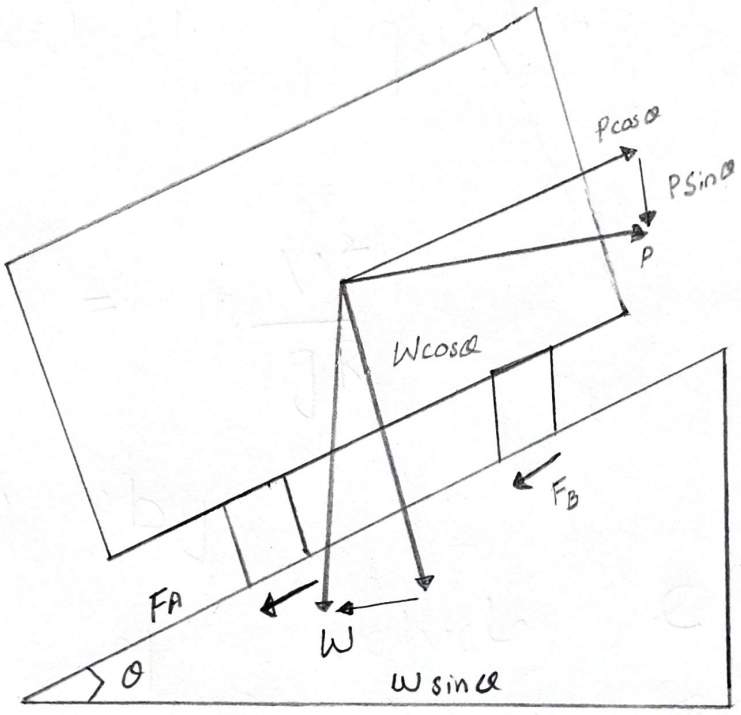
i) Speed of vehicle. $e \propto V^2$

ii) Radius of curve. $e \propto 1/R$

Larger the speed of vehicle. more Super elevation in curve is needed.

Smaller the radius of curve more super elevation in curve is needed.

Proof :-



Forces acting on a vehicle on horizontal curve of radius R(m) at a speed of V m/sec^2.

P = centrifugal force acting horizontally out-wards through the center of gravity.

W = weight of the vehicle acting down-words through the center of gravity and;

F = Friction force b/w the weels and pavement, along the surface inward.

A equilibrium, by resolving the forces parallel to the surface of pavement:

$$P\cos\theta = W\sin\theta + F_A + F_B$$

$$= W\sin\theta + f(R_A + R_B)$$

$$= W\sin\theta + f(W\cos\theta + P\sin\theta) \quad \text{①}$$

- where w is weight of a vehicle, P is centrifugal force, f is the co-efficient of friction, θ is the traverse slope due to super elevation.

Dividing eq① by $w\cos\theta$. & re-arranging

$$\frac{P\cos\theta}{W\cos\theta} = \frac{W\sin\theta}{W\cos\theta} + \frac{fW\cos\theta}{W\cos\theta} + \frac{fP\sin\theta}{W\cos\theta}$$

$$\frac{P}{W} = \tan\theta + f + f\frac{P}{W}\tan\theta$$

$$\frac{P}{W}(1 - f\tan\theta) = \tan\theta + f$$

$$\Rightarrow P/W = \frac{\tan\theta + f}{1 - f\tan\theta} \quad \text{—(ii)}$$

We know that

$$P = \frac{WV^2}{gR} \quad \text{or} \quad \frac{P}{W} = \frac{V^2}{gR} \rightarrow \text{(iii)}$$

Comparing eq(ii) & eq(iii)

$$\frac{V^2}{gR} = \frac{\tan\theta + f}{1 - f\tan\theta}$$

For small θ ($\theta < 4^\circ$) & $f = 0.15$ (generally)

* $1 - f \tan\theta = 1 \; (f \tan\theta = 0)$

* $\tan\theta = \theta = e$ ....

Above expression can be written as :-

$$\frac{V^2}{gR} = 0.01e + f$$

e = rate of road way superelevation, percent (number of vertical feet of rise per 100 ft of horizontal distance).

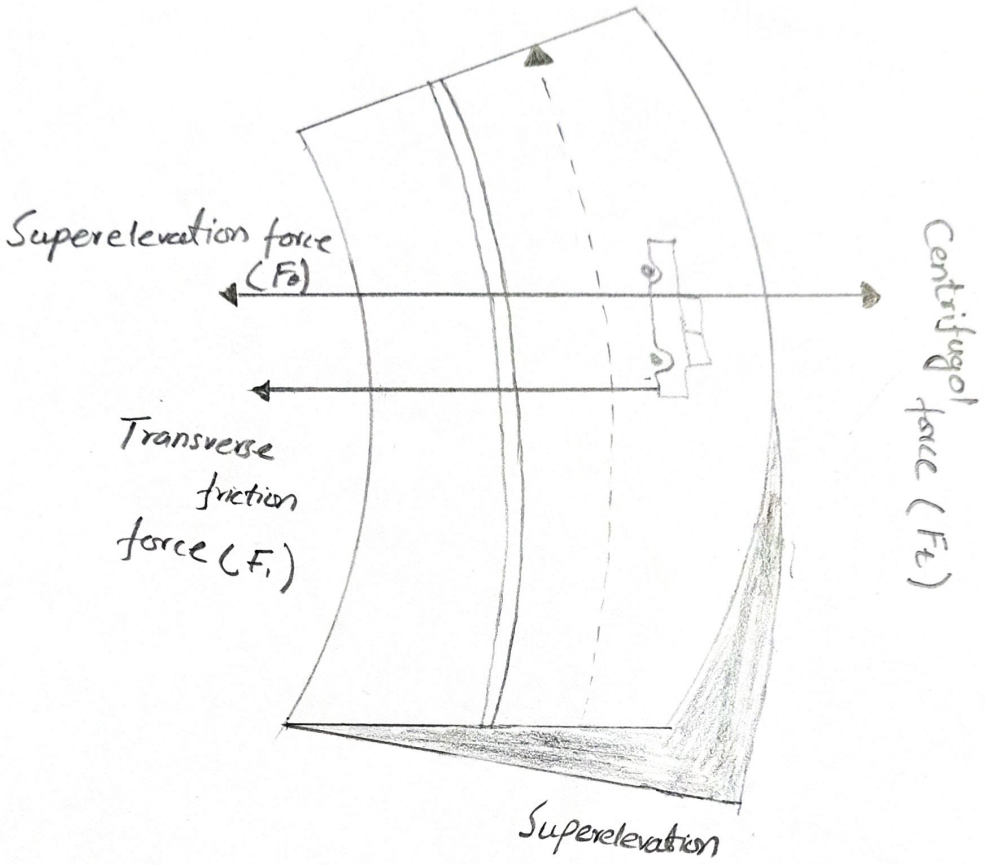
f = Side friction factor

g = Gravitation Constant

V = vehicle Speed.

R = Radius of curve measured to a vehicle's center of gravity.

Diagram:


Superelevation force (Fs)
Transverse friction force (Ft)
Centrifugal force (Fc)
Superelevation

Q:No:02 (C-2)

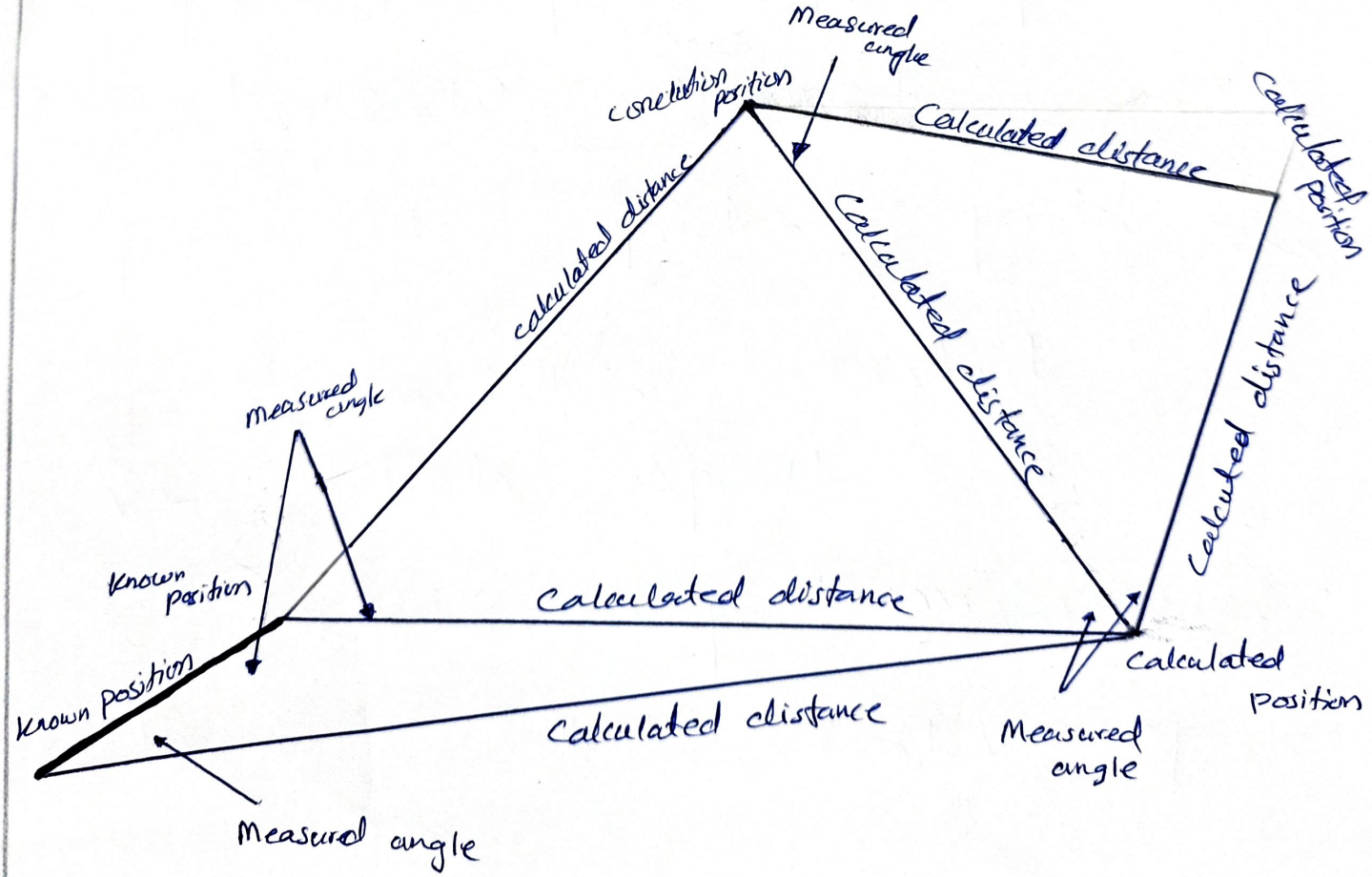
Difference b/w Trian & Trilat.

Trianguation	Trilateration
1- All angles are measured in triangulation.	1- All sides are measured in trilateration.
2- Distance of basement is measured.	2-Azimuth of the inial line is measured.
3- Some check base lines are also measured to control scale error.	3- Some check angles are measured to control azimuth error.
4- Intervisibility b/w solutions is essantial.	4- For small areas it is possible to measure distance without intervisibility.
5- There are more internal checks in comparison with trilateration in the ~~same~~ Sane geometric figure.	5- There are less internal checks in comparison with triangulation in the sane geometric figure.
6- The side lengths are computed on the basis of measured angles applying sin law.	6- The angles are computed on the basis of measured the lengths appplying cosin law.

Procedure (Difference blw triangulation & Trilateration):-

i) Triangulation :-

In triangulation, you work with angles as illustrated in the following figure.

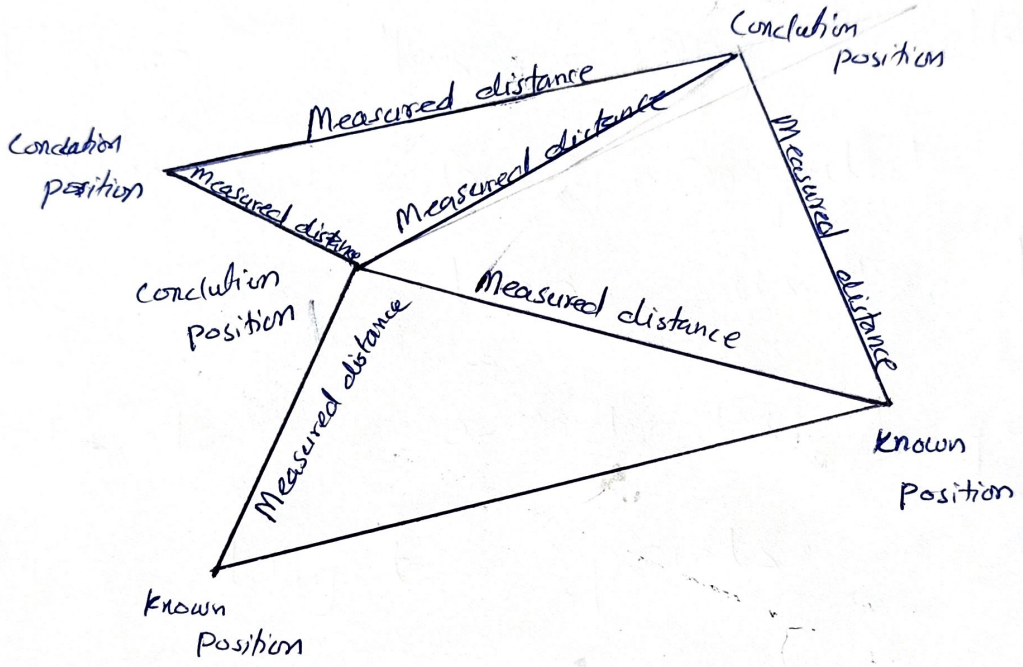


The position of the points of interest are computed based on measured angles and two know points. From those angles, the distances are computed which are in turn used to calculate co-ordinates for the target points.

Trilateration:-

In trilateration, you work with distances. From those distances, you compute the angles. Once computed you can use them in

Conjunction with the distances to get the position of the target points.



Principle of Triangulation:-

If all the three angles & the length of one side of a triangle are known, then by trigonometry the lengths

of the remaing sides of the triangle can be calculated.

Again, of the co-ordinates of any vertex of the triangle & azimuth of any side are also known, then co-ordinates of the remaining vertices may be computed.

Sine Rule:

$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)} \quad \text{or} \quad \frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{b}$$

(For finding sides) (For finding angles)

Principles of Trilateration:-

- All the three sides of each triangle are measured in the field with distance measuring instrument.
- Horizontal angles are not measured in the fields
- Angles in trilateration are computed indirectly from the lengths of sides of triangle by cosine formula.
- Few horizontal angles are also sometimes measured to provide a check on computed angles

Trilateration is adjusted cycles the computation of the angles & then co-ordinates of the stations are determined

- Vertical angles are also measured where elevations have not been established.

Cosine Rule

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$2bc\cos A = -a^2 + b^2 + c^2$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$A = \cos^{-1}\left(\frac{b^2 + c^2 - a^2}{2bc}\right)$$

Q: No: 03 Part (a) (C-2)

Hydrographic Survey:-

It is the branch of Surveying which deals with water bodies e.g Lake, river etc.

or

Hydrographic Survey is the science of measurment & description of features which affect maritime navigation, marine construction, dredging, off shore oil exploration off shore drilling & related activities.

The usual principles of levelling & Surveying are adopted for acquiring data for determination of :

i) water volume

ii) Rate of flow

iii) Determine shape of area underlying the water surface etc.

Why we do / purpose :-

i) TO determine the quantities of subaqueous excavations.

ii) Measure areas subjected to scouring or silting in harbours or docks.

iii) Locate rocks and other objects such as buoys, lights etc to aid safe navigation.

iv) To prepare navigation charts exhibiting the depths available for navigation.

v) Control floods, and to plan water supply and storage from ~~from~~ rivers.

vi) To develope water resources for power, irrigation & recreation.

Factors :-

1- The measurement of depth of water at various points is termed as sounding

2- Depth of Sounding is referred to the water level at the time it is made.

3- Thereafter, the Soundings are reduced to datum water level, to account for tidal waters which undergo, continual change of elevation, with the help of gauges.

4- A number of Benchmarks (B.M) are established at frequent intervals along the shorlines & gauges are set on them.

5- The field work consist of both horizontal as well as vertide control

6- The horizontal control is ~~measured~~ established by traversing or triangulation.

7- For verticle control, the tide gauges are kept in operation continously since the water level at thad gauge must also be known when soundings are recorded.

Q:NO:03 Part (b) (C-a)

b)

Sounding :-

" The process of determing depths below the water surface is called Sounding ".

Sounding is analogous to levelling on land.

The reduced level of any point on the bottom of a water body is obtained by subtracting the Sounding from the mean sea level.

Purpose of Sounding :-

1- Preparation of accurate charts for navigation.

2- Determination of the quantities of the material to be filled.

3- Obtaining information for design of break ~~past~~ waters, Sea walls.

Equipments :-

1- Shore Signal & buoys.

2- Sounding Equipment.

2.1) Sounding boat.

2.2) Sounding pole or rod.

2.3) Lead Line.

2.4) Weddell's Sounding machine

2.5) Echo Sounding machine or Fathometer

~~2.6~~)

3) Angle Measuring Equipment.

3.1) Theodolite.

3.2) prismatic Compass

3.3) Sextant.

Q:NO:04 Part(a) (C-2)

Aerial photogrammetry:

It is the branch of Surveying that deals with production of maps. Such as topographic maps by Compiling number of photographs taken in that area. from an air-Craft or other flying object "

In 1858. Gasper Felix Tournachon "Nadar" took the first aerial photograph from a captive ballon from a an altitude of 1200ft over paris.

Why we do A.P/ purpose?

→ For large tasks such as road building and major constructions, air survey methods are quicker & cheaper than ground methods.

→ Profiles for determingation of earthwork quantities can be simply obtained using aerial photographs.

- Land use maps.
- Hydrographic maps.
- Exploration & reconnaissance

→ It remains an important application of remote sensing. with a sophisticated range of cameras

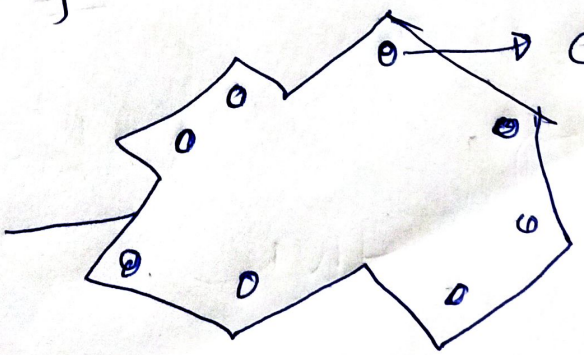
Q:NO:04 Part (b) (C-2)

Procedure of Aeriel photography:

Procedure consist of following steps:

1- Establishing Control points:

Control points are points established on ground with relative positions used as boundries. There should be min 3-4 control points for one photograph easily identifrable.



Aeriel photography area.

2- Flight planning and photography:

This planning mainly depends upon.

- Area to be surveyed.
- Focal length of camera.
- Overlap
- Scale of photograph
- Ground speed of aircraft in still air

Flight planning is used to determine height of flight, area to be covered on each photograph, number of photographs, no. of strips & time interval between exposures.

3) Photo- Interpretation

Stereoscopy:-

Photo interpretation is done by instrument called Stereoscope which contains magnifiers.

It gives 3D model of area and ease the drawing of maps of photo-graphed area.

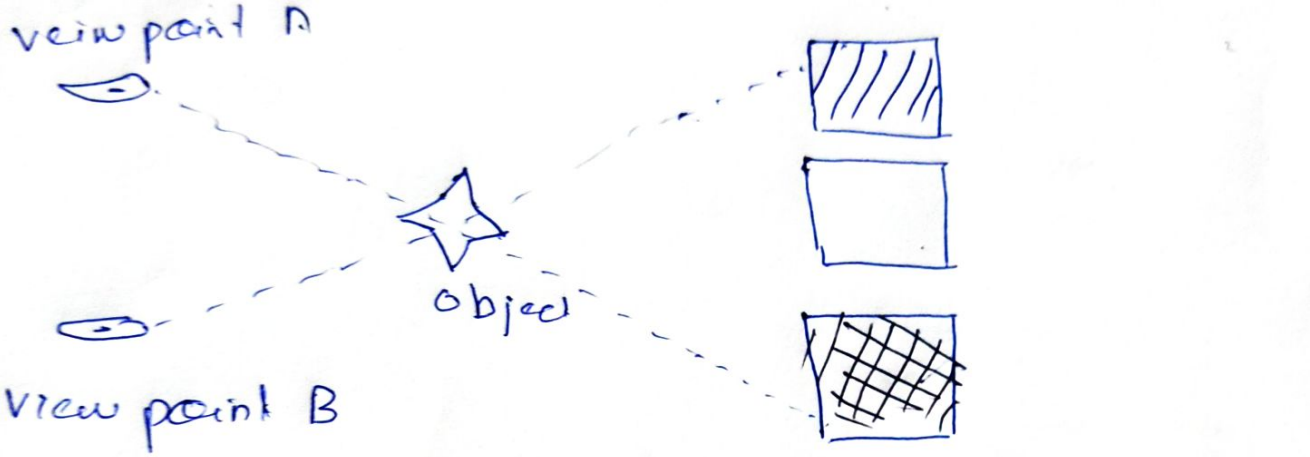
Control station, elevations, length of lines should be sufficiently available for accuracy.

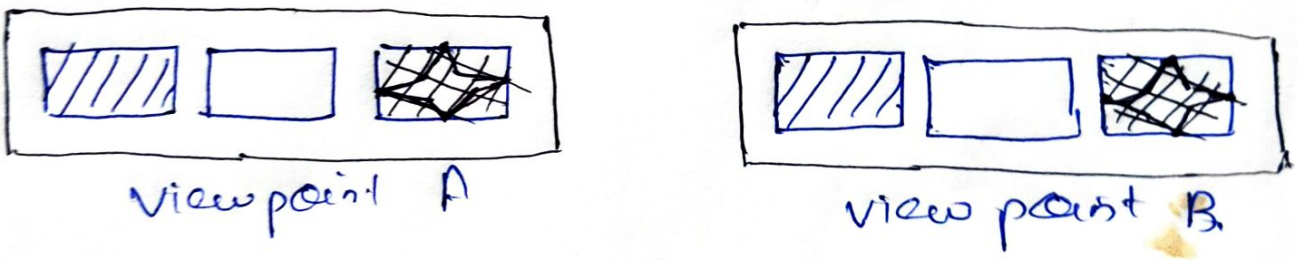
Different types of stereoscopes are available for photo interpretation.

4) Parallax & Measurement of parallax:-

parallax is a displacement

of an object in the photograph when point of observation is shifted to another angle.





5) Construction of Map & Cartography :-

After collection of photograph

we will going to plot the map.

various methods available to plot the map details of map but we will explain Stereoscopic method:.

In this method Stereo plotter or multiplex is used for preparing maps. Maps prepared by this method is of high resolution.

THE END