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Q1 Transition curve :

A curve of varying radius is called transition curve between tangent and a circular. It is also known as spiral curve. It can be inserted in between the two branches of a compound or reverse curve.

Types: There are three types of transition curve which are mentioned below

- i) Cubic Parabola (railways)
- ii) Clothoid or Spiral (railways)
- iii) Lemniscate (Highways)

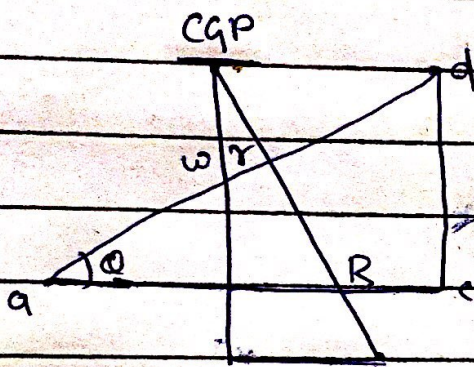
Superelevation: It is the amount by which the outer edge of a curve on a road or railway is banked above the inner edge. When a vehicle passes to a curved path, the following forces act on it.

- i) Weight of vehicle
- ii) Centrifugal force both acting through centre of gravity of vehicle.

The effect of centrifugal force is to push the vehicle off the track. Now to counter act the action, the plane of the road surface is made perpendicular to

resultant of centrifugal force & weight of vehicle. In other words the outer bank of road is raised above to the inner one. This raising of outer bank over the inner one is known as super elevation.

Mathematically



W = weight of vehicle

P = Centrifugal force

v = Speed of vehicle (m/sec)

g = acceleration due to gravity

R = radius of curve

h = Super elevation in m

b = width of road in m

C_1 = Distance between centre of rails

For equilibrium

The resultant of weight and centrifugal force must be equal & opposite to the reaction perpendicular to road.

As we know that

$$P = \frac{W v^2}{g R}$$

$$\frac{P}{W} = \frac{v^2}{g R}$$

If θ is the inclination of road surface the resultant of inclination of resultant to vertical is also θ , so we have

$$\tan \theta = \frac{dc}{ac} = \frac{P}{W} = \frac{bv^2}{gR}$$

On Roads:

$$b \tan \theta = \frac{v^2}{gR}$$

On Railways:

$$b \tan \theta = \frac{Gv^2}{gR}$$

Radius:

$$b \tan \theta = \frac{v^2}{gR}$$

$$R = \frac{v^2}{b \tan \theta g} \quad (\text{for roads})$$

$$b \tan \theta = \frac{Gv^2}{gR}$$

$$R = \frac{Gv^2}{b \tan \theta g} \quad (\text{for railways})$$

→ Speed of Vehicle

$$b \tan \theta = \frac{v^2}{gR}$$

$$v^2 = b \tan \theta g R$$

$$v = \sqrt{b \tan \theta g R}$$

For Roads

$$b \tan \theta = \frac{Gv^2}{gR}$$

$$v^2 = \frac{b \tan \theta g R}{G}$$

$$v = \sqrt{\frac{b \tan \theta g R}{G}}$$

For Railways

Qa:

Day:

M	T	W	T	F	S	S
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Ans 2 Triangulation:

- All angles measured in triangulation
- Distance of base line is measured.
- Some check base line are also measured to control scale error.
- Inter visibility b/w stations is essential
- There are more internal checks in comparison with trilateration in the same geometric figure.
- The side length are computed on the basis of measured angles applying sin law.

~~Trilateration:~~

Trilateration:

- All sides are measured in trilateration
- Azimuth of the initial line is measured
- Some check angles are measured to control azimuth error.
- For small areas it is possible to measure distance without intervisibility.
- There are less internal checks in comparison with triangulation in the same geometric figure
- The angles are computed on the basis of measured side length applying cosine law

Principles of Triangulation:

- If all three angles and the length of one side of the triangle are known, then by trigonometry the length of the remaining side of the triangle can be calculated.
- Again, if the coordinates of any vertex of the triangle and azimuth of any side are also known, then coordinates of the remaining vertices may be computed.

Principles of Trilateration:

- Trilateration is highly accurate & precise method of establishing and expanding horizontal control.
- Method of control survey in which a network of triangles is used as in triangulation system.
- All three sides of each triangle are measured in the field with the distance measuring instruments.
- Horizontal angles are not measured in the field.
- Angles in this system are computed indirectly from the lengths of sides of triangle by cosine formula.
- Few horizontal angles are measured sometimes measured to provide a check on computed angles.
- Vertical angles also measured if elevations not established.

Q3(a)

Ans 3(a) Hydrographic survey :

Hydrographic surveying is the survey of physical features present underwater. It is the science of measuring all factor beneath water that affect all the main activities like marine construction offshore drilling

Why we do it :

- To determine depth of bed
- Shore line can be determined
- locating mean sea level
- Tide measurement
- River & stream discharge measurement
- Massive structures like bridge, dam, harbour are planned.

● Factors to be determined while conducting

→ hydrographic survey : following are as below

- i) Survey equipment
- ii) Proportions of hydrographic survey specifications
- iii) Issue to be designated unit

- iv) Programme planning of that unit
- v) Assessment of the task within that unit
- vi) Resources allocation
- vii) Detailed survey planning
- viii) Plans for compilation and checking of data.

Qno3(b)

Ans 3(b) Sounding: The measurement of depth below water surfaces is called sounding. This corresponds to the ordinary spirit leveling in land surveying where depth are measured below horizontal line established by level.

• Purpose of sounding:

- Sounding is most important for any water body to improve its navigable properties to know about siltation & scouring.
- In hydrographic surveying, sounding is the measurement of depth below the water surface.
- In short, the main purpose and objective of sounding is to measure and find the depth below the water surface.

- Equipment :

- Sounding boat
- Sounding rods & poles
- Lead lines
- Sounding machine
- Fathometer

Q4(c)

~~Q4~~

Ans (c) In aerial photogrammetry, an aircraft with camera setup is used to take photograph from the air flying over the ground.

- Why do we do it?

A bird eye view can allow prospective to appreciate the size and scope of a building and the surrounding landscape which will draw their interest and encourage them to view the property in person. Aerial photogrammetry is also useful in showing land that is open for development to potential investor.

Q 4(b)

Ans 4(b) → Establishing control points :

Control points are points established on ~~control points~~ ~~are points~~ ground with known positions. The photographs captured is observed by setting these points as boundaries. so, these should be established in such a way that they should be easily identified on photographs.

→ Flight Planning & Photography :

Flight Planning are nothing but knowing the height to be maintain by flight while taking photos, areas to be covered in each photograph. This planning depend upon following factors

- 1) Area to be surveyed
- 2) Focal length of camera
- 3) Overlap
- 4) Scale of photo
- 5) Speed of aircraft

→ Photo interpretation & stereoscopy :

It is done by the instrument called stereoscope which contain magnifiers

So, one can observe 3 dimensional model of area through it and it is also ease the drawing of maps of photographed area. These are four types of stereoscope used for photo interpretation.

- 1) Lense stereoscope
- 2) Mirror Stereoscope
- 3) Scanning mirror stereoscope
- 4) Zoom Stereoscope

→ Parallax & measurement of Parallax:

An aerial photograph can be studied to get the location of an object by its coordinates in the photograph.

Parallax is nothing but a displacement of an object in the photograph when point of observation is shifted to another angle.

→ Construction of Map & cartography:

After collecting all photographs its time to create or plot the map these are several method available to plot the detail of map and one of the method is stereoscope method.

In this method, instrument will help to review the overlapped in 3 dimensional which helped to view the spatial model. then the model is measured & orthographically projected as map.