

# Question 1

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7926 (A)  
347 (2)

Page #1

## TRANSITION CURVE :-

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

### => TYPES :-

There are three types of transition curves which are given below.

- 1) Cubic Parabola (railways)
- 2) clothed or spiral (railways)
- 3) Lemniscate (highway)

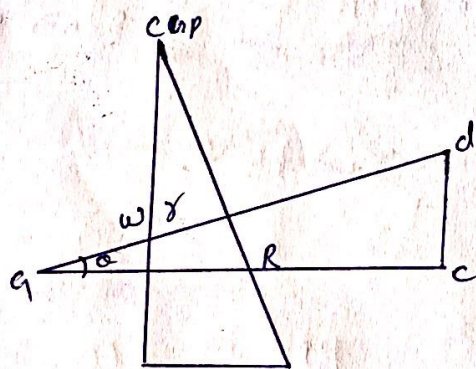
### => Superelevation :-

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~~ passes to a curved path, the following forces acts on it.

- weight of vehicle
- 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 counteract the action, the plane of the road surface is made perpendicular to resultant of centrifugal Force and weight of vehicle. In other words the outer bank of road is raised above the inner one. This raising of outer bank over the inner one is known as Superelevation.

⇒ Mathematically:



- ⇒  $W$  = weight of vehicle
- ⇒  $P$  = centrifugal Force
- ⇒  $v$  = Speed of vehicle (m/sec)
- ⇒  $g$  = acceleration due to gravity
- ⇒  $R$  = Radius of curve.
- ⇒  $h$  = superelevation in m
- ⇒  $b$  = width of road in m
- ⇒  $G$  = Distance between centre of axle

⇒ For equilibrium:-  
The resultant of weight and centrifugal Force must be equal and opposite to the reaction perpendicular to road.  
As we know that

$$P = \frac{Wv^2}{gR}$$

$$\Rightarrow \frac{P}{W} = \frac{v^2}{gR}$$

if  $\theta$  is the inclination of road surface, the inclination of resultant to vertical is also  $\theta$

$\Rightarrow$  So we know have:-

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

$\Rightarrow$  ON ROADS:-

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

$\Rightarrow$  Railways:-

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

$\Rightarrow$  Radius:-

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

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

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

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

$\Rightarrow$  Speed of vehicle

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

$$v^2 = b \tan \theta gR$$

$$v = \sqrt{b \tan \theta gR}$$

For Road

$$b \tan \theta = Gv^2$$

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

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

(Railway)

=> Q. No # 2

=> Answer

=> Triangulation it is a process in surveying in which tracing and measurements of series or a network of triangles is used for determining distances and relative positions of points over an area.

=> Principles

- In triangulation all the three angles of each triangle are in the field along with one base line.
- The side of the first triangle whose length is predefined is called base line, and vertices of the individual triangles are known as triangulation stations.
- To minimize accumulation of errors in length, substations are provided.

=> Trilateration

- The method of surveying in which the length of the sides of a triangle are measured and from this information, angles are computed.
- This method does not involve the measurement of angles.

## ⇒ PRINCIPLES:

- It is a method of control Survey in which a network of triangles is used as in triangulation.
- All the three sides of each triangles are measured in the field.
- with distance measuring instruments.
- Horizontal angles are measure in the field.
- Triangulation is adjusted after the computation of the angles and then coordinates of the stations are determined.
- In triangulation angles are computed indirectly from the lengths of the sides of triangles.

## => Difference between triangulation and trilateration:

- => In triangulation All angles of the triangles are measured. While in trilateration, all sides of triangles are measured.
- => In triangulation, base line is measured while in trilateration Azimuth of initial line is measured.
- => For triangulation, intervisibility between stations are essential - ~~while~~ ~~in trilateration~~ while in trilateration, it is possible to measure distances without intervisibility.
- => There are more internal checks in triangulation as compared to that of trilateration

## ⇒ QUESTION 3

⇒ Past #A

Ans: Hydrographic Survey:

Hydrographic Surveying or bathymetric Surveying is the survey of physical features present under water. It is science of measuring all factors beneath water that affect all the water activities like dredging marine construction offshore drilling etc.

⇒ Hydrographic surveying is mainly conducted under authority concern. It is mainly carried by means of sonar, sounding or electronic sensor system for shallow water.

⇒ Why we do hydrographic surveying?

- Depth of bed can be determined
- Shore lines can be determined.
- Locating sewer fall by measuring direct current
- Locating mean sea level.
- Tide measurement.
- River and stream discharge measurement.
- ⇒ Massive structure like bridges, dams, harbors are planned.

=> Factors to be determined while conducting  
Hydrographic Survey.

- Survey Equipment.
- Preparation of a hydrographic Survey Specification.
- Plan for compilation and checking of data.
- Resource allocation.
- Reconnaissance requirement.
- Detailed Survey planning.
- Issue to a designated unit.
- Programme planning of that unit.



=> Question # 3=> Part # B=> Sounding:

The measurement of depth below the water surface is called sounding. This corresponds to the ordinary spirit levelling in land surveying where depth are measured below horizontal line establish by level. The object of making sounding is to determine the configuration of the subaqueous source.

=> Purpose of Sounding:

Sounding is most important for any water body to improve its navigable properties to know about sitting and scarcity etc.

=> In hydrographic surveying sounding is the measurement of depth below the water surface.

⇒ In short main purpose and objective of sounding to measure and finding the depth below the water surface.

⇒ Equipment:-

1. Sounding boat.
  2. Sounding rods and poles.
  3. Fathometers.
  4. Lead lines.
  5. Sounding Machine.
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# Question-4

Page # 11

Part (A)

## Aerial Photogrammetry:-

It is a process in which an aircraft with camera is used to take photograph from certain height in the air. A minimum 3 to 4 control points needed in one photograph.

## Reason use of aerial photogrammetry:-

It provides computer generated 2D and 3D models. These models are topographical in nature. They represent the dimensions and physical features of the area of land and stunning accuracy.

These model can be zoomed and rotate.

Along with surveying many of the uses of aerial photogrammetry in different fields.

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# Question # 4

Page # 12

## Part # B

### Procedure of aerial photography:

- > Establishing Control points
- > Construction of map and cartography
- > Parallax and measurement of parallax
- > Flight Planning and photography.

### Establishing Control Points

Control points are points established on ground with known relative positions. The photography captured is observed by setting these control points as boundaries. There should be minimum 3 to 4 points in a photograph.

### Flight Planning and Photography:-

Flight Planning is actually knowing the height to be main while taking photo area to be covered in each photograph, Number of photographs, no of strips and time interval between exposures.