

final term

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Name :- Ibrar Ahmad

ID No. 7914

Sec- A

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Subject: Advanced Engineering  
Surveying

Instructor:- Sir Abdul Farhan

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Q No. 01

Ans

Transition Curve

Transition Curve is also known as spiral curve.

A transition curve is curve of varying radius between tangent and a circular curve.

It can be inserted in between two branches of a compound or reverse curve.

Types of Transition Curve:-

There are three common types

i) Cubic parabola.

ii) Spiral or clothoid

iii) Lemniscate.

examples are railways and highways

## Superelevation:

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

- Weight of vehicle
- Centrifugal force both acting through center of gravity of vehicle.

The centrifugal force's effect is to push the vehicle off the track.

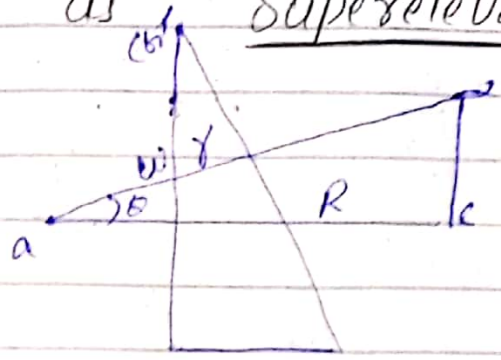
Now to counteract the action the plane of the road surface is made perpendicular to the resultant of centrifugal force and weight of vehicle.

The outer bank of the road is raised above the inner one.



The raising of outer edge of a road over the inner one is known as Superelevation.

mathematically:-



$W =$  wt. of vehicle

$P =$  Centrifugal force

$V =$  Speed of vehicle

$g = 9.8 \text{ m/sec}^2$

$R =$  radius of curve

$h =$  Superelevation in m.

$b =$  Width of road in m.

$G =$  distance b/w center of rails.

for equilibrium

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

Now, we know;

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



If  $\theta$  is the inclination of road surface, then inclination of resultant to vertical is also  $\theta$ .

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:-

for roads;

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

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

for railways;

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

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

Speed of Vehicle:roads;

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

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

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

railways;

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

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

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



Q No. 02

Ans

(a) Triangulation:

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

Principles of triangulation:

- In triangulations, 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 predetermined is called "base line", and vertices of the individual triangles are known as "triangulation stations".

- To minimize accumulation of errors in lengths, subsidiary bases at suitable intervals are provided.

### (b) Trilateration:

The method of Surveying in which the lengths of the sides of a triangle are measured and from this information angles are computed.

This method does not involve the measurements of angles.

### Principles of trilateration:

- It is a method of Control Survey in which a network of triangles is used as in triangulation.

- All the three sides of each triangle are measured in the field.



→ With distance measuring instruments.

- Horizontal angles are measured in the field.
- Trilateration is adjusted after the computation of the angles and then coordinates of the stations are determined.
- In trilateration, angles are computed indirectly from the lengths of the sides of triangles.

# Difference between triangulation and trilateration:-

① In triangulation, All angles of the triangles are measured while in trilateration, all sides of triangles are measured.

② In triangulation, base line is measured while in trilateration Azimuth of initial line is measured.

③ For triangulation, intervisibility between stations are essential while in trilateration, It is possible to measure distances without intervisibility.

④ There are more internal checks in triangulation as compared to that of trilateration.



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Q No. 63 part (a)

Ans:-

## Hydrographic Survey:-

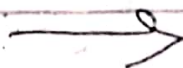
Hydrographic Surveying is the Survey of physical features present underwater.

In this Survey, we study all factors which effect the marine construction like dredging, marine construction, off shore drilling and dams etc.

It is mainly conducted by means of Sensors, Sounding or electronic Sensor System for shallow water.

## Why we do hydrographic Survey:-

In order to collect the following informations



- ① Depth of bed can be determined.
- ② Locating Sewere falls by measuring direct current.
- ③ Tide measurment.
- ④ Shore lines can be determined.
- ⑤ locating mean sea level.
- ⑥ To construct massive structures like bridges and dams etc.
- ⑦ River and stream discharge measurment.

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## Factors To Be Determined while conducting Hydrographic Survey:-

Given factors should be kept in mind while conducting Hydrographic Survey.

- preparation of a hydrographic Survey specification:
- Issue to a designated unit.
- assessment of the task with in that unit.
- Resource allocation
- Reconnaissance requirement.
- Detailed Survey planning.

X ————— X

Q No. 03 (b)

Ans:

### Sounding:

It is the process of measuring depth below the water surface.

This corresponds to the ordinary spirit leveling in land surveying where depth are measured below horizontal line.

The objective of performing sounding is to determine the configuration of the sub aqueous source.

### purpose of Sounding:-

It is important for water body to improve its negligible properties, to know about silting and scouring etc.



→ In Hydrographic Survey,  
Sounding is the measurement  
of depth below the water  
Surface.

→ main purpose and objective  
of sounding to measure  
and find depth below  
Water Surface.

Equipments used for Sounding:

- 1) Sounding boat
- 2) Fathometer
- 3) Lead lines
- 4) Sounding rods and poles.

QNo. 04 part (a)

Ans:

Aerial photography :-

Aerial photogrammetry :-

It is a process in which an aircraft with camera setup is used to take photographs from certain height in air.

A minimum of 3 to 4 control points needed in one photograph.

Reasons for use of Aerial photogrammetry :-

following are some of the reasons for uses of Aerial photogrammetry.

• It provides Computer generated 2D, 3D models.

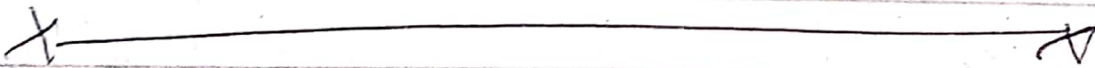
These models are topographical in nature





(18)

- It represents dimension and the physical features of the area of land and in Stumping accurately.
- Along with this Surveying, many of the uses of Aerial photogrammetry is used different fields.



Question no. 04 part (b).

Ans:-

Procedure of Aerial  
photogrammetry:

- Establish control points.
- flight planing and photography.
- photo in interpretation and Stereoscopy.
- parallax and measurement of parallax
- Construction of map and Cartography.

(a) Establish Control Point:-

These points are of known elevations and act as boundaries for selected ground.

(b) flight planing and photo graphy.

It is the time of decision about height which is to be maintained while

while taking photographs.

Area Covered in photographs  
number of photographs etc.

## Photo interpretation and Stereoscopes

Interpretation is done by Stereoscope which contain photo magnification for observing dimensional model of area so we can draw maps.

Lens Stereoscopes, mirror, Scanning mirror and 3D zoom stereoscope are available.

## Parallax and measurement of parallax:

Its an error, its the displacement of objects in maps.

## Construction of map:-

After collecting all photographs we can create or plot maps.

X ————— X  
THE END