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Section A.

SUBJECT ADVANCE ENGINEERING
SURVEYING.

⇒ Question No 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 between the two branches of a compound curve.

OR

⇒ A curve of constantly changing radius, used to connect a circular arc to a straight line or to an arc of different curvature.

⇒ Types :-

It has three types
 ⇒ Spiral or clothoid

⇒ Cubic parabola.

⇒ Lemniscate.

⇒ Super elevation :-

It is the amount by which the outer edge of a curve on a road or railway is banked above the inner edge.

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⇒ when a vehicle passes to a curved path the following forces acts on it-

- (i) weight of vehicle.
- (ii) Centrifugal force both acting on centre of gravity of vehicle.

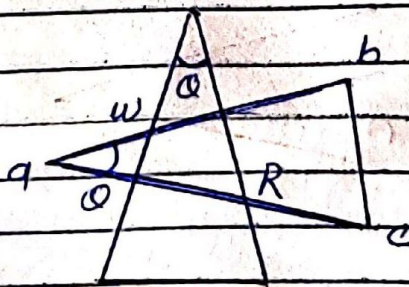
⇒ The effect of centrifugal force is to push the vehicle off the track. Now to counteract the action,

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

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 Super elevation.

⇒ Mathematically:-



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

As we know that

$$P = \frac{w v^2}{gR}$$

w = weight of vehicle.

P = Centrifugal force

v = Speed of vehicle.

g = Acc due to gravity

R = radius of curve

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

If " θ " is the inclination of road surface, the inclination of resultant to vehicle is also " θ ".
So we have.

$$\tan \theta = \frac{d_e}{a_e} = \frac{P}{w} = \frac{b v^2}{gR}$$

On Roads:-

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

On Railways:-

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

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⇒ Radius :-

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

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

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

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

⇒ Speed of vehicle :-

$$\textcircled{i} \quad v^2 = b \tan \theta gR$$

$$\Rightarrow v = \sqrt{b \tan \theta gR} \quad (\text{for Roads})$$

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

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

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QNO 2:

→ TRIANGULATION:-

In Surveying the tracing and measurement of a series or networks of triangles in order to determine the distance and relative positions of points spread over an area, especially by measuring the length of one side of each triangle and deducing its angles and the length of the other two sides by observation from this base line.

⇒ formation of or division into triangles.

⇒ PRINCIPAL OF TRIANGULATION:-

⇒ 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 predetermined is called "base line" and the vertices of the individual triangles are known as triangulation "stations".

(b)

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

⇒ **TRILETRATION :-**

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

⇒ This Methode does not involve the measurements of Angles.

⇒ **PRINCIPAL OF TRILETRATION :-**

⇒ 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.

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⇒ Triangulation is adjusted after the computation of the angles and then co-ordinates of the stations are determined.

⇒ In triangulation, angles are computed indirectly from the lengths of the sides of triangles.

⇒ Difference B/w

Triangulation And Triangulation:-

① In triangulation, All angles of the triangles are measured.

while in triangulation all sides of triangle are measured.

② In triangulation base line is measured

while in triangulation the azimuth of initial line is measured

③ For triangulation the intervisibility between stations are essential

while in triangulation. It is possible to measure distances without intervisibility.

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

(5) In triangulation some check base angles are also measured to control scale error.

while in trilateration some check angles are measured to control azimuth error.

⇒ QNO 3 :

PART A :

Hydrographic Survey :-

⇒ Hydrographic Surveying is the survey of physical features present under water.

⇒ It is the science of measuring all factors beneath water that effect all the marine activities like dredging, marine construction, offshore drilling etc.

⇒ Hydrographic Survey is mainly conducted under authority of the concerned authority.

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It is mainly carried by means of sensor sounding or electronic sensor system for shallow water.

Why do Hydrographic Surveying

⇒ In order to get the following information

- ① Depth of bed can be determined.
- ② Shore lines can be determined.
- ③ Locating sewer fall by measuring direct current.
- ④ Locating mean sea level.
- ⑤ Tide measurement.
- ⑥ River and stream discharge measurement.
- ⑦ Massive structures like bridge dams harbor's are planned.

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⇒ factors to be determined while conducting Hydrographic Survey :-

1) Survey Equipment.

2) Preparation of a Hydrographic Survey Specification (To include a review of existing data).

3) Issue to a designated Unit.

4) Programme planning of that Unit.

5) Assessment of the task with in that Unit.

6) Reconnaissance requirement.

7) Resource allocation.

8) Detailed Survey planning.

9) Plans for completion and checking of data.

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QNO 3 :-

PART B :-

⇒ SOUNDING :-

The measurement of depth below the water surface is called Sounding.

⇒ This corresponds to the ordinary spirit leveling in land surveying. Where depths are measured below horizontal line established by level. The object of making sounding is thus to determine the configuration of the seabed source

⇒ PURPOSE OF SOUNDING :-

⇒ Sounding is most important for any water body to improve its navigable properties, to know about silt and scouring etc.

⇒ 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.

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⇒ Equipment :-

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

⇒ Question No 4 :-

AERIAL PHOTOGRAMMETRY :-

Aerial photogrammetry is the process in which an aircraft with camera is used to take photograph from certain height in air.

⇒ A minimum 3 to 4 control points needed in one photograph

⇒ Reasons for use of Aerial photogrammetry :-

⇒ It is used because it provides computer generated 2D and 3D models. These models are.

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topographic in nature. They represent the dimensions and physical features of the area of land and is accurate

⇒ These models can be rotated and zoomed.

⇒ Along with Surveying there are many other uses of Aerial photogrammetry in other different fields.

⇒ Aerial photogrammetry is used in Cartography, land-use planning, archaeology, mine production, environmental studies, espionage, Commercial advertising, Cartography and other fields.

⇒ **QUESTION :-**

→ **PART B :-**

→ **PROCEDURE OF AERIAL PHOTOGRAPHY:**

⇒ The main steps of Aerial photography.

i) Establishing Control points

ii) flight planning and photography.

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3) Photo Interpretation and Stereoscopy.

4) Parallax and measurement of parallax.

5) Construction of map and Cartography.