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Subject # Advanced Eng  
Survey

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## Quest # (1)

What is transition curve? How super diagram?

Ans) Transition Curve :-

A curve of varying ~~radius~~ 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 or reverse curve.

Types :-

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

- ① Cubic Parabola (railways)
- ② Clothoid or Spiral (railways)
- ③ Lemniscate (highways).

Superelevation :-

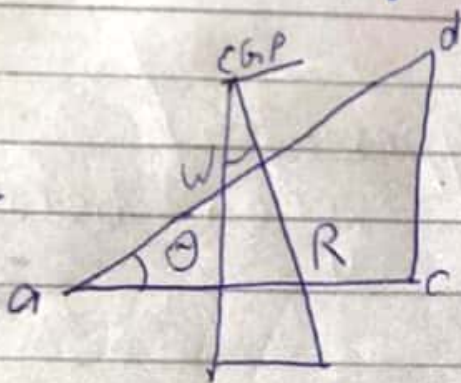
It is the amount by which the outer edge of a curve on a road or railway is banked above the inner edge when a vehicle passes to a curved path, the following forces act on it.

- \* Weight of vehicle
- \* Centrifugal force both acting through centre of gravity of vehicle.

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The effect of centrifugal force is the 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. The raising of outer bank over the inner bank 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 ground in m.
- $r$  = distance b/w centre of rails.

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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.

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

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

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

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

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Radius :-

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

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

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

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

Speed of Vehicle :-

For roads

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

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

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

For Railways

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

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

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

Question # (2)

Q 2) What is the difference between triangulation and trilateration? Also explain

Ans) Triangulation

Trilateration

- |   |   |
|---|---|
| ① All angles are measured in triangulation.   | All sides are measured in trilateration.  |
| ② Distance of base-lines is measured  | ② Azimuth of the initial line is measured.  |
| ③ Some check baselines are also measured to control scale error.                                | ③ Some check angles are measured to control Azimuth error.  |
| ④ Intervisibility b/w station is essential.   | ④ For small areas it is possible to measure distances without Intervisibility.                            |
| ⑤ There are more internal checks in comparison with trilateration in the same geometric figure. | ⑤ There are less essential internal checks in comparison with triangulation in the same geometric figure. |
| ⑥ The side lengths are computed on the basis of measured angles applying sine law.              | ⑥ The angles are computed on the basis of measured side lengths applying Cosine law.                      |

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## Principle of Triangulation :-

\* If all the three angles and the length of one side of a triangle are known then by trigonometry the lengths of the remaining sides of the triangle can be calculated.

\* Again if the coordinates of any vertex of the triangle and azimuth of any side are also known, the coordinates of the remaining vertices may be computed.

## Sine Rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

## Principle of Trilateration :-

\* Trilateration is a highly accurate and precise method of establishing and expanding horizontal control.

\* Method of controlling survey in which a network of triangles is used as in triangulation system.

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- \* All the three sides of each triangles are measured in the field with the distance measuring instruments (EDMs, tapes, other apparatus).
- \* Horizontal angles are not measured in the field.
- \* Angles in trilateration system are computed indirectly from the length of the sides of triangles.
- \* Few horizontal angles also sometimes measured to provide a check on compute angles.
- \* Trilateration is adjusted after the computation of the angles and then coordinates of the stations are determined.

Cosine Rule:

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



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### Question #3

Part (a)

What is hydrographic Survey?  
Why we do hydrographic Survey?

Ans) Hydrographic Survey :-

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

Hydrographic survey is mainly conducted under authority concern. It is mainly carried by means of sensor, sounding or electric sensor system for shallow water.

WHY WE DO Hydrographic Survey =>

In order to get following information we do hydrographic Survey.

- ① Depth of bed can be determined.
- ② Shorelines can be determined.
- ③ Locating sewer fall by measuring direct current.

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- ④ Locating mean sea level.
- ⑤ Tide measurement.
- ⑥ River and stream discharge measurements.
- ⑦ Massive structures like bridges are planned.

⇒ Factors to be determined  
Conducting hydrographic Survey :-

Following are the factors which would be done by doing and Conducting hydrographic Survey.

- a) Survey Equipment.
- b) Preparation of a hydrographic survey specification (To include a review of existing data)
- c) Issue to a designated unit.
- d) programme planning of that unit
- e) Resource allocation.
- f) Detailed Survey planning.
- g) Plans for compilation and checking of data.

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# Q #3 Part #B

## Sounding :-

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

## ⇒ Purpose of Sounding :-

→ Sounding is most important for any water body to improve its negligible properties to known about silting and scouring etc

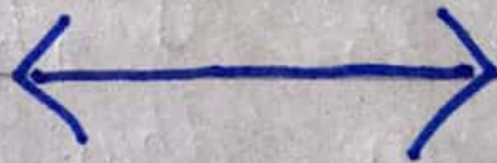
→ In hydrographic surveying sounding is the measurement of depth below the water surface.

→ In short the main purpose and objective of sounding is measuring and finding 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.



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## Question #4

### Part # A

What is aerial photogrammetry and why we do it?

### Aerial Photogrammetry :-

In terrestrial photogrammetry photographs are taken from a fixed position on ground while in the aerial photogrammetry an aircraft with camera setup is used to take photographs from the air flying over ground.

### Why we do it :-

⇒ Because it is an important application of remote sensing, with a sophisticated range of camera being used to collect information on geology, land use, agricultural management, water, forestry etc.

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Quest #4 Part #B

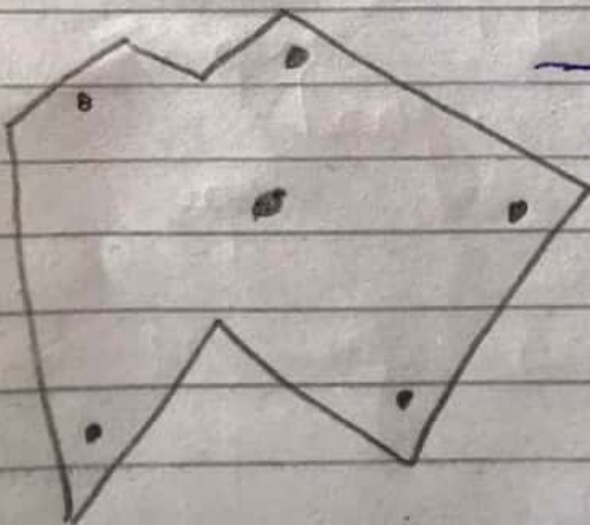
## \* Procedure of Aerial Photography

Establishing Control points:-

⇒ There should be minimum of 3 to 4 control point are needed in one photograph.

⇒ Its depend on scale of map.

⇒ A right controls and cartographic method of mapping.



— Aerial Photography area  
• Ground Control point

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## Parallax and Measurement of Parallax:-

An aerial photography can be studied to get the location of an object by its co-ordinates in the photography.

⇒ Similarly to know the third dimensionally of same object, there should be minimum of two points of observation is needed from different angles.

## Construction of Map and Cartography:-

After collecting photographs it's time to create plot the map.

There are several methods available to plot the detail of map.

⇒ Stereoscopic method is one of them

