

FINAL TERM EXAMINATION

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SECTION B

DEPARTMENT BE (C)

SUBJECT ADVANCE ENGINEERING SURVEY

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## QUESTION No 01

What is Transition Curve

----- help of equation and diagram?

### TRANSITION CURVES :-

It is usually a horizontal curve in plan provided to allow transition from straight alignment to a circular curve gradually

OR

It is a curve which connects with a infinite radius and radius  $R$ .

It is used on both highway and railway between tangent and a circular curve in order to have a smooth transition from tangent to the curve and from curve to tangent

It is also called Spiral Curve or Easement curve.

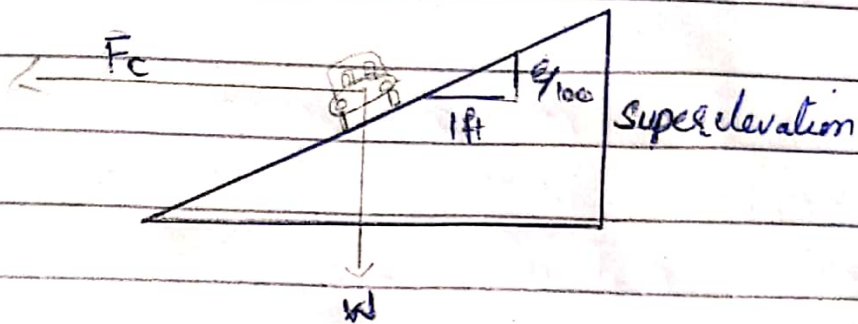
These curves are used to built up there forces gradually and uniformly thus ensuring the safety of passengers.



# SUPER ELEVATION :-

## DEFINITION :-

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



-> It is represented by "e".

-> The amount of superelevation depends on two things and also it affects the amount of superelevation.

- i) Speed of vehicle
- ii) Radius of the curve.

## PROOF :-

Superelevation is effected by speed of vehicle and radius of curve.

Let

$W =$  Weight of the Vehicle

$P =$  Centrifugal force

$V =$  Speed of vehicle (m/s)

$g =$  Acceleration due to gravity ( $m/s^2$ )

$R =$  Radius of curve (m)

$h =$  Super elevation (m)

$b =$  Width of the Road (m)

Now for equilibrium the resultant  $R$  of the centrifugal force and weight of vehicle must be equal & opposite to the reaction perpendicular to road or rail surface.

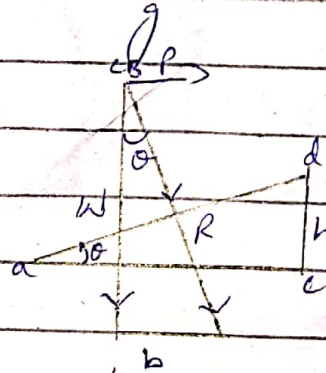
As we know that

$$P = \frac{mv^2}{R}$$

Where  $W = mg \Rightarrow m = \frac{W}{g}$

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

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



Now From the  $\Delta acd$   
 $\tan \theta = \frac{h}{b} = \frac{dc}{ac} = \frac{P}{W}$



$$\tan \theta = \frac{h}{b} = \frac{P}{W} = \frac{V^2}{gR}$$

$$\Rightarrow h = b \tan \theta \quad \text{--- (i)}$$

Put  $\tan \theta = \frac{V^2}{gR}$  in eq (i)

$$\Rightarrow h = \frac{bV^2}{gR} \quad \text{--- On highway}$$

$$\Rightarrow h = \frac{bGV^2}{gR} \quad \text{--- On Railway}$$

Where  $G =$  Distance b/w center of Rail.

Now if the radius of the curve is small the super elevation is greater and vice versa. It has inverse relation with radius

Now if the speed of vehicle we want high so we kept super elevation high. i.e It has direct relation between each other.



## QUESTION NO 02

What is different between  
triangulation and trilateration?

TRIANGULATION	TRILATERATION
i) Triangulation consist of a numbers of interconnected triangles in which the length only one base line and the angles of the triangles are measured very precisely which are used to calculate the coordinates of vertices	In Trilateration the lengths of all sides of chain of triangles, polygon, or quadrilaterals are measured with an electronic instrument or others; the angles then may be computed from these field measurements
ii) All angles are measured in triangulation	All sides are measured in trilateration.
iii) Distance of baseline is measured.	Azimuth of initial line is measured.
iv) Some check base lines are also measured to control scale error	Some check angles are measured to control azimuth error.
v) Intervisibility between stations is essential	For small areas it is possible to measure distance without intervisibility.
vi) There are more internal checks in comparison with trilateration in the same	There are less internal checks in comparison with triangulation in



geometrical figure	the same geometrical figure.
vii) The side lengths are computed on the basis of measured angles applying sine law.	The angles are computed on the basis of measured side lengths applying cosine law.

### PRINCIPAL OF TRIANGULATION :-

→ If all the angles and one the length of one side of 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, then coordinates of the remaining vertices may be computed

### SINE RULE :-

For Finding Sides

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

OR

For Finding Angles

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

## PRINCIPLES OF TRILATERATION :-

→ 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 a trilateration system are computed indirectly from the lengths of the sides of triangle by cosine formula:

→ Few horizontal angles are also sometimes measured to provide a check on computed angles.

→ Vertical angles are also measured where elevation have not been established.

Cosine Rule :-

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

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

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

$$A = \cos^{-1} \left[ \frac{b^2 + c^2 - a^2}{2bc} \right]$$



## QUESTION No 03 (a)

What is hydrographic survey.  
... .. conducting hydrographic survey?

### HYDROGRAPHIC SURVEY :-

#### DEFINITION :-

-> Hydrographic surveying is the branch of surveying which deals with water bodies i.e lake, rivers etc

-> The usual fundamental principles of surveying and levelling are adopted for acquiring data for determination of :

- Water volume
- Rate of flow
- Determine the shape of the ~~to~~ underlying the water surface etc.

-> We can also say that Hydrographic surveying is the survey of physical features present under water.

# PURPOSE OF HYDROGRAPHIC SURVEYING :

Following are the purpose of hydrographic surveying.

- > To determine the quantities of subaqueous excavations
- > Measure area subjected to scouring or silting in harbours or docks.
- > locate rocks and other objects such as buoys, lights etc to aid safe navigation.
- > To prepare navigation charts exhibiting the depths available for navigation
- > Control floods, and to plan water supply and storage from rivers
- > To develop water resources for power, irrigation and recreation



## FACTORS OF HYDROGRAPHIC SURVEYING 82

Following are the factors that why we do hydrographic surveying.

- i) Depth of bed can be determined.
- ii) locating mean sea level.
- iii) Tide measurement.
- iv) Shore lines can be determined.
- v) locating sewer fall by measuring direct current.
- vi) River and stream discharge measurement.
- vii) Marine structures like bridges, dams, harbours are planned.

## QUESTION No 03 (b)

What is sounding and purpose used to determine sounding?

### SOUNDING :-

#### DEFINITION :-

The process of determining depth below the water surface is called sounding.

OR

The measurement of depth of water at various points is called as sounding.

→ The corresponds to the ordinary spirit leveling in land surveying where depth are measured below horizontal line establish by level. The object of making sounding. Thus to determine the configuration of the sub aqueous source.



## PURPOSE OF SOUNDING:~

Following are the purpose of sounding.

- i) Preparation of accurate charts for navigation
- ii) Determination of the quantity of the material to be filled
- iii) Obtaining information for design of breakwaters, sea, wells etc

## EQUIPMENTS OF SOUNDING:~

Following are the name of the equipments of sounding

- 1 Sounding boat
- 2 Sounding Pole or rod



- 3) Lead line
- 4) Weddell's Sounding machine
- 5) Echo-sounding machine/Fathometer

### QUESTION No 04 (a)

What is aerial Photogrammetry and why we do it?

### AERIAL PHOTOGRAMMETRY

Photogrammetry is the branch of surveying that deals with production of maps such as topographic maps by compiling numbers of photographs taken in that area.

→ In Aerial Photogrammetry, an aircraft with camera setup is used to take photographs from air flying over the ground.



## PURPOSE OF AERIAL PHOTOGRAMMETRY

Following are the reasons why we do Aerial Photogrammetry.

-> The ability to chart a wide area of land that has been photographed from the sky and then create a scaled computer model of that area.

-> Some times it is difficult to survey a large area of land on foot. This is where UAV's come in. They make all the process of surveying land more affordable and efficient.

-> Just as UAV's make it safe and more convenient for surveyors to do their jobs, so, too, can they respond in providing disaster relief i.e. earthquakes, wild fires, floods etc.

-> Another practical use of UAV photography and consequently photogrammetry is in public safety primarily in accident scene reconstruction.



## QUESTION No 04 (b)

Shortly explain the procedure of aerial photography?

### PROCEDURE OF AERIAL PHOTOGRAPHY

There are five main points to do Aerial Photography.

- Establishing control points
- Flight planning and photography
- Photo interpretation and stereoscopy
- Parallax and measurement of parallax
- Construction of map and cartography.

#### 1 ESTABLISHING CONTROL POINTS:-

→ Control points are points established on the ground with known relative position. There should be of minimum 3 to 4 control points and they are established in such a way that they can easily identifiable on photography.

→ It depends upon scale of map, flight control, and cartographical method of mapping.



## 2) FLIGHT PLANNING:-

It depends mainly upon the following factors.

- Area to be surveyed
- Focal length of camera
- Overlap
- Scale of photograph
- Ground speed of aircraft in still air

## 3) PHOTO INTERPRETATION:-

Photo interpretation is done by the instrument called stereoscope which contains magnifier. So one can observe the three dimensional model of area. For accuracy, control stations, elevations, length of lines should be sufficiently available.

There are 4 types of stereoscopes available for photo interpretation which are as follows.

- Lens stereoscope
- Mirror Stereoscope
- Scanning mirror stereoscope
- Zoom stereoscope

#### 4) MEASUREMENT OF PARALLAX :-

→ Parallax is a displacement of an object in the photograph when point of observation is shifted to another angle.

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

#### 5) CONSTRUCTION OF MAP :-

After collecting all photographs its come to create or plot the map. The One of the method is as follow.

#### → STEREOSCOPIC METHOD :-

In stereoscopic plotting method an instrument called stereo platter or multiplex is used for preparing maps. The maps prepared by this method is of high precision.