

Total No. of Questions: 6

Total No. of Printed Pages: 3

Enrollment No.....



Duration: 3 Hrs.

Faculty of Engineering
End Sem (Odd) Examination Dec-2018
CE3CO01 Engineering Surveying

Programme: B.Tech.

Branch/Specialisation: CE

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. The sum of external angles of a closed traverse of sides "n" is: 1
(a) $(n+2) 180^\circ$ (b) $(n+3) 90^\circ$
(c) $(n+1) 90^\circ$ (d) $(n-2) 180^\circ$
- ii. Which of the following is not a method for calculation of area 1
(a) Mid ordinate method (b) Trapezoidal method
(c) Simpson's method (d) Total ordinate rule
- iii. In anallactic lens: 1
(a) $K=1000 C=0$ (b) $K=100 C=0$
(c) $K=0 C=1000$ (d) $K=0 C=100$
- iv. Which of the following is correct expression regarding tacheometer: 1
(a) $K = f/i$ (b) $C = f + d$
(c) $1/f = 1/f_1 + 1/f_2$ (d) All of these
- v. Versed sine of angle Θ is: 1
(a) $(1 - \cos\Theta)$ (b) $(1 - \sin\Theta)$ (c) $\text{Sec } \Theta$ (d) $(1 - \text{cosec } \Theta)$
- vi. An ideal transition curve is: 1
(a) A clothoid (b) A cubic parabola
(c) A parabola (d) Bernoulli's lemniscate
- vii. For India, geodetic survey was done using: 1
(a) Plane table traverse (b) Trilateration
(c) Triangulation (d) Compass traverse
- viii. Which of the following is used to measure soundness: 1
(a) Fathometer (b) Sound boat
(c) Both (a) and (b) (d) None of these

P.T.O.

[2]

- ix. The vertical photographs do not represent the true plan of ground due to:
(a) Ground relief (b) Tilt (c) Drift (d) Overlap

x. The GPS space segment consist of Navigation Satellite Timing and Ranging whose number is
(a) 8 (b) 12 (c) 16 (d) 24

Q.2

 - What is distance of visible horizon? Write down the distance of visible horizon for combined effect of earth curvature and refraction?
 - An observer standing on the deck of a ship just sees a light house. The top of light house is at 64m above the sea surface and height of the observer's eye is 4m. Find the distance of observer from Light house
 - In order to ascertain the elevation of the top (Q) of the signal on a hill, observations were made from two instrument stations P and R at a horizontal distance 100m apart, the stations P and R being in line with Q. The angles of elevation of Q at P and R were 30° and 20° respectively. The staff readings upon the bench mark of elevation of 290 were respectively 2.87 and 3.75 when the instrument was at P and at R, the telescope being horizontal. Determine the elevation of the foot of the signal if the height of the signal above its base is 3m.

OR

 - A flag post of height 2m was erected on a top of a building. Find the R.L. of top of flag post, if the vertical angle to the bottom and the top of it is measured as 7° and 10° respectively from a point staff reading on a B.M. from the same point $0^{\circ}0'0''$ was 1.245m. (R.L. of B.M. = 100m)

Q.3

 - Write down the characteristics of Tacheometer.
 - What is Stadia system and Subtense bar system in Tacheometric survey?

OR

 - Two sets of tacheometric readings were taken from an instrument station A, the reduced level of which was 100.06 m to a staff station B.
(a) Instrument P - Multiplying constant = 100
Additive constant = 0.06 m , staff held vertical
(b) Instrument Q - Multiplying constant = 90
Additive constant = 0.06 m, staff held normal

1

1

2

5

5

2

8

[3]

Instrument	At	To	Height of Instrument	Vertical angle	Stadia readings (m)
P	A	B	1.5 m	26°	0.755, 1.005, 1.255
Q	A	B	1.455 m	26°	?

What should be the stadia reading with instrument Q?

- Q.4** i. Explain different types of vertical curves.
ii. What are the elements of simple circular curve? Also write down mathematical expressions with the help of neat sketch diagram.
OR iii. A 7.5 m wide road deflects through an angle of $51^{\circ}35'$. The forward chainage of intersection is 8778.5 m. A circular curve of 185 m radius is to be inserted for a design speed of 75 km/hr at a rate of change of radial acceleration of $0.47 \text{ m/s}^2/\text{s}$. Find the length of the transition curve, the maximum super-elevation of outer curve. If pegs are at 10 m interval then determine the chainage of points.

Q.5 i. What do you mean by reconnaissance survey?
ii. What is the principle of triangulation? What do you understand by triangulation system? Describe most commonly used figures in triangulation system.
OR iii. What do you mean by Check base and Base line? What are the factors for selecting the site for base line?

Q.6 Attempt any two:
i. Write a short note on:
 (a) Sounding boat (b) Fathometer
ii. Explain how the GPS works? Also write down its applications.
iii. (a) What is Drift and Relief displacement?
 (b) The size of one vertical photograph is 30 cm x 20 cm. If longitudinal lap is 40% and side lap is 30%. The scale of photograph is 1 cm = 200 m. Find out the total number of photographs required to cover a total area of 1200 km^2 on ground.

* * * *

Marking Scheme

Engineering Survey (CE3C001)

MCQ

A-1 (a) $(n+2) 180^\circ$

A-2 (d) Total Ordinate rule.

A-3 (b) $k=100$ $C=0$.

A-4 (d) All of these.

A-5 (a) $(1 - \cos\theta)$

A-6 (a) A clothoid.

A-7 (c) Triangulation

A-8 (c) Both (a) and (b)

A-9 (a) Ground relief.

A-10 (d) 24.

Q.2(i) - Give two marks for four points i.e. Max (4 points).

Q.2(iii) - Solution (2)(iii)

Elevation of instrument axis at P = RL of B.M. +

Staff reading

$$= 290 + 2.870 = 292.870 \text{ m.}$$

01 mark

Elevation of instrument axis at R = RL of B.M. + Staff reading.

$$= 290 + 3.750 = 293.750 \text{ m}$$

Difference in Level of instrument axis at the two stations
 $= S = 293.750 - 292.870 = 0.88 \text{ m.}$

Q.2 (iii) Continue.

$$\alpha_1 = 30^\circ \text{ and } \alpha_2 = 20^\circ$$

1 mark

$$Scot \alpha_2 = 0.88 \cot 20^\circ = 2.69 \text{ m}$$

From eq. we have:-

$$D = \frac{(b + Scot \alpha_2) \tan \alpha_2}{\tan \alpha_1 - \tan \alpha_2} = \frac{(100 + 2.69) \tan 18^\circ 6' }{\tan 28^\circ 42' - \tan 18^\circ 6'} = 152.1 \text{ m.}$$

$$h_1 = D \tan \alpha_1 = 152.1 \tan 28^\circ 42' = 83.264 \text{ m.}$$

RL of foot of signal = RL of inst. axis at $P+h_1$ - ht. of signal.

$$= 292.87 + 83.264 - 3 = \cancel{373.144} \text{ m.}$$

$$\text{Check } \therefore (b+D) = 100 + 152.1 = 252.1 \text{ m.}$$

$$h_2 = (b+D) \tan \alpha_2 = 252.1 \times \tan 18^\circ = 91.757 \text{ m.}$$

RL of foot of signal = RL of inst. axis at $R+h_2$ - height of signal.

$$= \cancel{293.750} + \cancel{91.757} - 3 = \cancel{382.507}.$$

$$293.750 + 82.396 - 3 = \boxed{370.426 \text{ m.}}$$

Ans

Q.2 (ii)

Solution - 2(ii)

Let A be the position of top of light house and B be the position of observer's eye.

Let AB be tangential to water surface at O.

The distance d_1 and d_2 are given by

$$d_1 = 3.8553 \sqrt{C_1} \text{ km.}$$

$$= 3.8553 \sqrt{64} \text{ km.} = 30.842 \text{ km.}$$

$$d_2 = 3.8553 \sqrt{4} = 7.7106 \text{ km.}$$

Distance b/w A and B = $d_1 + d_2$.

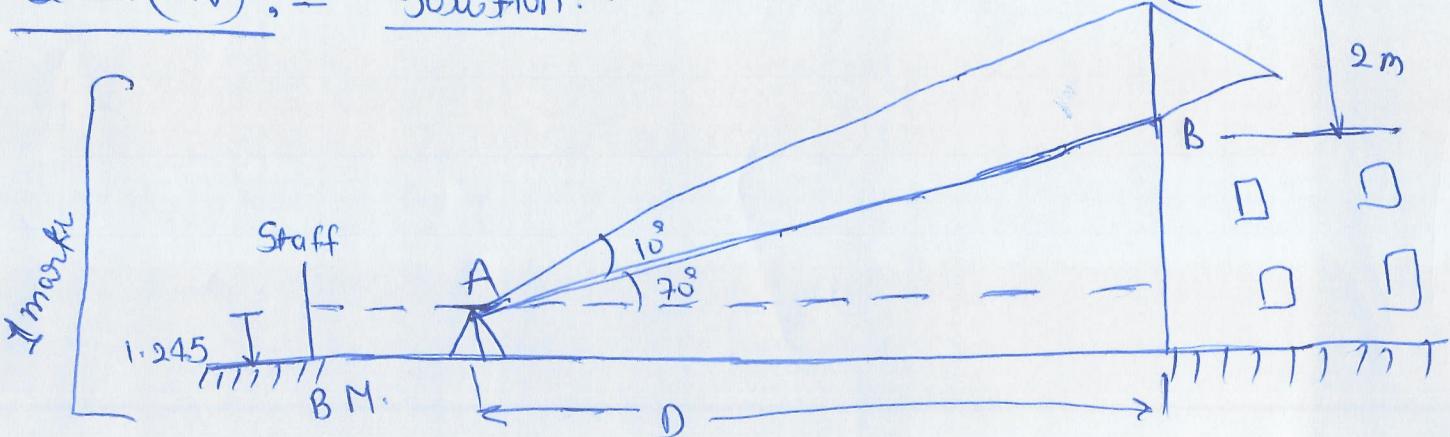
$$= 30.842 + 7.7106 \text{ km.}$$

$$= 38.552 \text{ km.}$$

(i.e. 3marks)

2marks-

Q.2 (iv) :- Solution:-



Continue

Q.2(iv) :- RL of BM = 100m.

$$\begin{aligned} \text{H.I of instrument} &= 100 + 1.245 \\ &= 101.245. \end{aligned}$$

h_1 = height of building

from $\triangle ABD$.

$$h_1 = D \tan 1^\circ,$$

$$h_1 = D \tan 7^\circ \quad h_1 = 0.123D \quad \text{--- (i)}$$

From $\triangle ADC$,

$$h_1 + 2 = D \tan 10^\circ$$

$$h_1 = 0.176D - 2 \quad \text{--- (ii)}$$

Equating (i) and (ii)

$$0.123D = 0.176D - 2$$

$$= 0.053D = 2$$

$$D = 37.7 \text{ m}$$

$$h_1 = 4.63 \text{ m}$$

$$\text{R.L. of flag post} = \text{RL of BM} + 1.245 + h_1 + 2$$

$$= 100 + 1.245 + 4.63 + 2$$

$$= 107.875 \text{ m}$$

Ans

(i.e., 5 marks)

Q3(iii) - Solution:-

(i) Observations with instrument P: Staff vertical

$$AB = ks \cos^2 \theta + c \cos \theta$$

$$S = 1.255 - 0.755 = 0.5 ; k=100; c=0.06 \text{ m.}$$

$$AB = 100 \times 0.5 \cos^2 26^\circ + 0.06 \cos 26^\circ = 40.45 \text{ m.}$$

$$V = AB \tan \theta = 40.45 \tan 26^\circ = 19.73.$$

$$\text{R.L. of B} = 100.06 + 1.5 + 19.73 - 1.005 = 120.285.$$

(ii) Observations with instrument Q: Staff normal

Let the stadia readings be r_1 , r_2 , and r_3 .

$$S = r_1 - r_2 = 2(r_1 - r_2)$$

$$= AB = ks \cos \theta + c \cos \theta + r_3 \sin \theta$$

$$\Rightarrow 40.45 = 90 s \cos 26^\circ + 0.06 \cos 26^\circ$$

$$\Rightarrow 80.89 s + 0.4384 r_3 = 40.4. \quad \text{--- (1)}$$

$$\text{Also } V = ks \sin \theta + c \sin \theta = 90 s \sin 26^\circ + 0.06 \sin 26^\circ \\ = (39.46 s + 0.03)$$

$$\text{RL of B} = 100.06 + 1.45 + V - r_1 \cos 26^\circ = 101.51 + \\ + (39.46 s + 0.03) - 0.8988 r_3$$

$$= 101.54 + 39.46 s - 0.8988 r_3$$

$$\text{But RL of B} = 120.285.$$

$$120.285 = 101.54 + 39.46 s + 0.8988 r_3.$$

or $39.46 S - 0.8988 \eta = 18.745 \quad \text{--- (2)}$

Solving eq. (1) and (2)

$$S = 0.49 \text{ m} ; \eta = 0.63 \text{ m.}$$

$$S = 2(\eta_1 - \eta_2).$$

$$\eta_1 = \frac{0.49}{2} + \eta = 0.245 + 0.63 = 0.875$$

$$\eta_2 = \eta_1 - S = 0.875 - 0.49 = 0.385.$$

Hence, the readings are $0.385, 0.63, 0.385$

Q. 3(i) Give 2 marks for four characteristic of tacheometer survey.

Q. 3(ii) Give stadia system explanation 4 marks for 8 points and subtense bar system explanation give 4 marks i.e. for 8 points.

Q. 4(i) Give three marks for 3 types of vertical curves!

Q. 4(ii) For elements of simple circular curve give 3 marks and for mathematical expression give 3 marks, for neat sketch give one mark i.e. (7 marks).

Q. 4(iii)

Solution :

7.5 m wide road.

$$L = \frac{V^3}{2R}$$

$$\lambda = 0.47 \text{ m}^3/\text{s}^2$$

$$R = 185 \text{ m}$$

$$V = 75 \text{ km/hr.} = 20.8 \text{ m/sec.}$$

$$L = 102.38 \text{ m.}$$

$$e = 1.18 \frac{V^2}{\pi} = 2.75 \text{ Ans}$$

4 marker

3 marks

i.e. = 7 marks

Q. 5(i) For 1 marks two points considered, i.e. 6 points for (3 marks).

Q. 5(ii) For principle of Triangulation give (2 marks)
for briefing triangulation system give (2 marks)
for describing common figures in triangulation give (3 marks)

i.e. (7 marks)

Q. 5(iii) For check base and base line give (2 marks).

for factors affecting site selection give (5 marks)
i.e. (7 marks)