B. Tech.
(SEM. IV) EXAMINATION, 2011
ADV. SURVEYING

Time: 3 Hours]
[Total Marks: 100

Note:
(1) Attempt all questions.
(2) All questions are compulsory.
(3) Use of calculator is permitted.

1 Attempt any two of the following: 10x2=20

(a) What are the essential requirements for selection of triangulation stations. Describe the methods for ascertaining the intervisibility between the triangulation stations.

(b) What do you understand by satellite stations? Derive the necessary equations for corrections if the observations are taken with a satellite station.

(c) The three bays of a base line were measured by a steel tape in catenary as 30.084, 29.973 and 25.233 m, under respective pulls of 7, 7 and 5 kg, temperatures of 12°, 13°, and 17°C and differences of level of supports of 0.3, 0.7 and 0.7 m. If the tape was standardized on the flat at a temperature of 15°C under a pull 4.5 kg, what are the lengths of the bays? 30 m of tape is exactly 1 kg with steel at 8300 kg/m³, with a coefficient of expansion of 0.000 011 per °C and

\[ E = 210 \times 10^3 \text{ N/mm}^2 \]

[Contd...]
Attempt any two of the following: 10×2=20

(a) Explain the meaning of the terms random error and systematic error, and show by example how each can occur in normal surveying work. In a triangulation scheme, the three angles of a triangle were measured and their mean values recorded as 50° 48' 18"", 64° 20' 36"" and 64° 51' 00"". Analysis of each set gave a standard deviation of 4"" for each of these means. At a later data, the angles were re-measured under better conditions, yielding mean values of 50° 48' 20"", 64° 20' 39"" and 64° 50' 58"". The standard deviation of each value was 2"". Calculate the most probable values of the angles.

(b) Explain the following:
   (i) Standard Error and Weight of an Observation.
   (ii) Principle of Least Squares.

(c) In the levelling network in, point A is a benchmark and has an assumed height of 100.00 m. Levelling has been undertaken along the lines as shown. The observed height differences were:

<table>
<thead>
<tr>
<th>Line Observed</th>
<th>height difference</th>
<th>Approximate line length</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX</td>
<td>12.483m</td>
<td>5 km</td>
</tr>
<tr>
<td>AY</td>
<td>48.351m</td>
<td>10 km</td>
</tr>
<tr>
<td>AZ</td>
<td>5.492m</td>
<td>7 km</td>
</tr>
<tr>
<td>XY</td>
<td>35.883m</td>
<td>7 km</td>
</tr>
<tr>
<td>XZ</td>
<td>−7.093m</td>
<td>12 km</td>
</tr>
<tr>
<td>YZ</td>
<td>−42.956m</td>
<td>9 km</td>
</tr>
</tbody>
</table>

The standard errors of the observed difference heights are believed to be:

\[ \sigma_{\Delta h} = 0.017 \sqrt{K} \text{ m, where } K \text{ is the line length in km.} \]

Find the best estimate of the heights of points X, Y and Z.
3 Attempt any two of the following:  

(a) The straight lines $ABI$ and $CDI$ are tangents to a proposed circular curve of radius 1600 m. The lengths $AB$ and $CD$ are each 1200 m. The intersection point is inaccessible so that it is not possible directly to measure the deflection angle; but the angles at $B$ and $D$ are measured as 

$$\angle ABD = 123^\circ 18';\ \angle BDC = 126^\circ 12'$$

and the length $BD$ is 1485 m.

Calculate the distances from $A$ and $C$ of the tangent points on their respective straights and calculate the deflection angles for setting out 30-m chords from one of the tangent points.

(b) What are transition curves? Describe the importance. Derive the equation for an ideal transition curve.

(c) A falling gradient of 4% meets a rising gradient of 5% at chainage 2450 m and level 216.42 m. At chainage 2350 m the underside of a bridge has a level of 235.54 m. The two grades are to be joined by a vertical parabolic curve giving 14 m clearance under the bridge. List the levels at 50-m intervals along the curve.
4. Attempt any two of the following: \(10 \times 2 = 20\)

(a) Describe the process for the route location for a railway.

(b) Two vertical wires A and B hang in a shaft, the bearing of AB being 35° 10' 30''. A theodolite at C, to the right of the line AB produced, measured the angle ACB as 20' 25''. The distances AC and BC were 6.4782 m and 3.2998 m respectively. Calculate the perpendicular distance from C to AB produced. The bearing of CA and the angle to set off from BC to establish CP parallel to AB produced.

(c) What do you understand by an astronomical triangle? Describe its components with the help of a neat sketch.

5. Attempt any two of the following: \(10 \times 2 = 20\)

(a) Explain the following:

(i) Relief Displacement

(ii) Tilt Distortion

(b) Write short notes:

(i) Atmospheric Window

(ii) Spectral signature

(c) Describe the following:

(i) Differential GPS

(ii) Kinematic GPS