BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

AEH 206

Department of Engineering and Physics
Bachelor of Science (Honours) Agricultural Engineering Part 2 Examination
Engineering Survey

3 HOURS (100 MARKS)

INSTRUCTIONS

JUN 2024

Answer any ***FOUR*** questions. Each question carries 25 marks.

Question one

a) Briefly explain the following errors in surveying
   i. Random errors [5 marks]
   ii. Systematic errors [5 marks]

b) Explain the following sources of errors in surveying
   i. Natural errors [2 marks]
   ii. Instrument errors [2 marks]
   iii. Personal errors [1 mark]

c) Describe any test that can be carried out to determine the collimation error of a level [10 marks]

Question two

a) A surveyor has a unit pace of 0.9 m/pace.
   a. Calculate the distance if she walks 37 paces between points C and D [5 marks]
   b. Calculate the number of paces the same surveyor should Count to lay out a line roughly 122 m long [5 marks]

b) The following readings were taken with a level and a 4 m staff. Draw up a booking sheet and reduce the levels by the height of instrument method 0.578 B.M. (=58.250 m), 0.933, 1.768, 2.450, (2.005 and 0.567) C.P., 1.888, 1.181, (3.679 and 0.612) C.P.,0.705, 1.810. [15 marks]

Question three

a) Explain the following types of direct levelling:
   i. Differential levelling, [2 marks]
   ii. Fly levelling, [2 marks]
   iii. Profile levelling [2 marks]
   iv. Cross section levelling and [2 marks]
   v. Reciprocal levelling [2 marks]

b) A line was determined to be 2395.25m when measured with a 30m steel tape supported throughout its length under a pull of 4kg and at a mean temperature of

35°C. Determine the correct length of the line if the tape used is of standard length at 20°C under a pull of 5kg, the cross-sectional area of the tape is 0.03 cm^2, its coefficient of linear thermal expansion is 0.0000116/°C, and the modulus of elasticity of steel is 2.0 x 106 kg/cm^2 [12 marks]

c) The reduced level of a factory floor is 30 m and the staff reading on the floor is 1.40m. The staff reading when held inverted with the bottom touching the Tee- beam of the roof is 3.67 m. Calculate the height of the beam above the floor [3 marks]

Question four

a) Discuss the circumstances under which the Rise and Fall or HPC method would be used for reducing levels [10 marks]

b) The readings shown in figure 1 were taken to find the heights of pegs (X, Y and Z) between A and B. Calculate the adjusted reduced levels for the pegs. [15 marks]

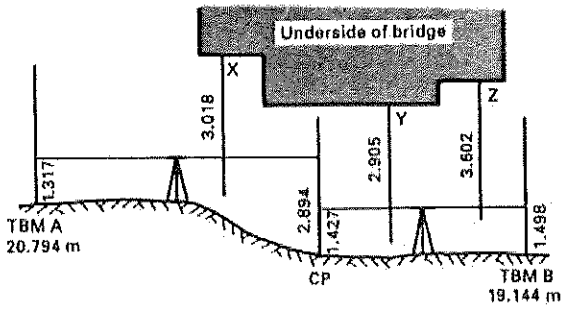

Figure 1

Question five

A link traverse was run between stations A and X as shown in the traverse diagram of figure 2. The coordinates of the controlling stations at the ends of the traverse are shown in table 1.

Table 1

	E (m)	N (m)
A	1769.15	2094.72
B	1057.28	2492.39
X	2334.71	1747.32
Y	2995.85	1616.18

Calculate the coordinates of stations 1, 2, 3 and 4, adjusting any misclosure by the Bodwitch method [25 marks]

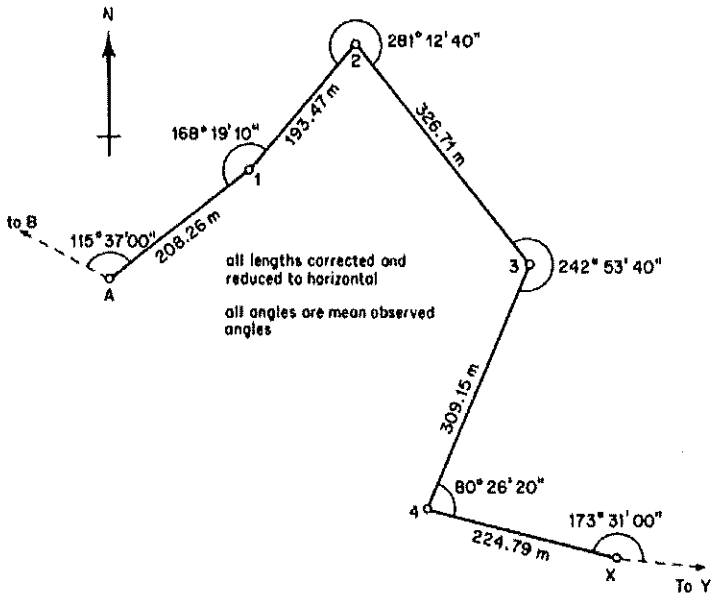

Figure 2

Question six

A new sewer is to be laid to drain a housing development to a manhole on an existing sewer. The centres of the proposed manholes A, B and C on the new sewer have been pegged out on site and the levels of the tops of the pegs were measured as follows:

A = 98.13 m B = 98.23 m C = 98.68 m

The new sewer is to be constructed to fall into the manhole on the existing sewer and proposed manhole A is 80.00 m, with successive horizontal distance intervals between AB and BC being 66.00 m and 52.00 m, respectively. The cover level of the manhole on the existing sewer is 97.53 m and the formation level at the bottom of this manhole is 1.87 m below its cover level. If a 3.00 m traveller is to be used during the construction of the trench for the new sewer, calculate:

a. The height of the sight rail required above the cover of the existing manhole [5 marks]

b. The heights of the sight rails required above the tops of the pegs defining Proposed manholes A, B and C. [15 marks

c. With the aid of illustrations, explain the use of offset pegs in setting out operations [5 marks]