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FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI  
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY  
DEPARTMENT OF CIVIL ENGINEERING

HARMATTAN SEMESTER EXAMINATION, 2017/2018 SESSION

ENG 315- Principles of Engineering Survey

Date: 02/05/2018

Instruction: Answer Questions 1, 5 and any other two

Time:  $2 \frac{1}{2}$  hours

**QUESTION 1:** (a) A tape which was standardized on flat under a tension,  $P_s$  was used in catenary to measure the length of a base line. Show that the nominal corrections for pull and sag must be modified by factors  $\pm \frac{\partial P}{(P-P_s)}$  and  $\mp \frac{2\partial P}{P}$  respectively, if an error,  $\pm \partial P$  occurred in the applied field tension,  $P$ .

(b) A standard base was established by accurately measuring with a steel tape the distance between fixed marks on a level bed. The mean distance recorded was 24.984 m at a temperature of  $18^\circ\text{C}$  and an applied tension of 155 N. The tape used had recently been standardized in catenary and was 30 m in length at  $20^\circ\text{C}$  and 100 N tension. Calculate the true length between the fixed marks given: total weight of the tape = 0.90 kg; coefficient of expansion of steel =  $11 \times 10^{-6}/^\circ\text{C}$ ; cross-sectional area =  $2\text{mm}^2$ ;  $E = 210 \times 10^3 \text{N/mm}^2$ ; gravitational acceleration =  $9.807 \text{m/s}^2$ . (c) At a later date the tape was used to measure a 30-m bay in catenary. The difference in level of the measuring heads was 1 m, with an error of 3 mm. Tests carried out on the spring balance indicated that the applied tension of 100 N had an error of 2 N. Ignoring all other sources of error, what is the probable error in the measured bay?

**QUESTION 2:** (a) Explain the principle and field work of chain surveying. What is offset? Explain two types of offsets. (b) What is field book? The base line AC of a chain survey is measured and the following records are noted: (i) The corners of a building are 9 and 9.5 m from chainage 7.5 and 18 m. The building is 7 m wide; (ii) A 4m wide road runs about parallel to the right of the chain line. Offsets are 2, 2.1, 2.2 and 2.51 m at chainages 0, 20, 40 and 55.5 m respectively; (iii) A check line is taken from the sub-station at chainage 25 m to the left; (iv) The total chainage of the base line is 55.5 m; and (v) The fore bearing and back bearing of the base line are  $30^\circ 30'$  and  $210^\circ 30'$  respectively. Make the entries in a field book (use double-line field book).

(c) A chain line PQ intersects a pond. Two points A and B are taken on the chain line on opposite sides of the pond. A line AC, 250 m long, is set out on the left of AB and another line AD, 300 m long, is set on the right of AB. Points C, B and D are in the same straight line. CB and BD are 100 and 150 m long respectively. Calculate the length of AB

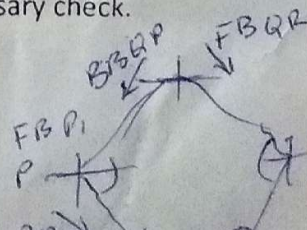
**QUESTION 3**

(a) Define Fore bearing, FB and Back bearing, BB with respect to compass traversing. Starting from the first principle, show that  $BB - FB = \pm 180^\circ$

(b) The bearings of the sides of a closed traverse PQRSTP are as follows:

Side	FB	BB
PQ	$107^\circ 15'$	$287^\circ 15'$
QR	$22^\circ 00'$	$202^\circ 00'$
RS	$281^\circ 30'$	$101^\circ 30'$
ST	$181^\circ 15'$	$1^\circ 15'$
TP	$124^\circ 45'$	$304^\circ 45'$

Compute the interior angles of the traverse and exercise necessary check.





**QUESTION 4:** (a) Explain the term Local attraction. State how it can be detected in the field during compass traversing.

(b) The following bearings were observed with a compass on traverse:

Line	FB	BB
AB	191°45'	13°00'
BC	39°30'	222°30'
CD	22°15'	200°30'
DE	242°45'	62°45'
EA	330°15'	147°45'

Which stations is affected by local attraction? Find the correct bearings of the lines

**QUESTION 5 (a)** With instrument at B, the staff reading at A and C are 2.765 and 2.675. With instrument at D, the staff reading at A and D are 4.235 and 3.897 respectively. Calculate the collimation error in the instrument and correct it. (See Fig. Q5)

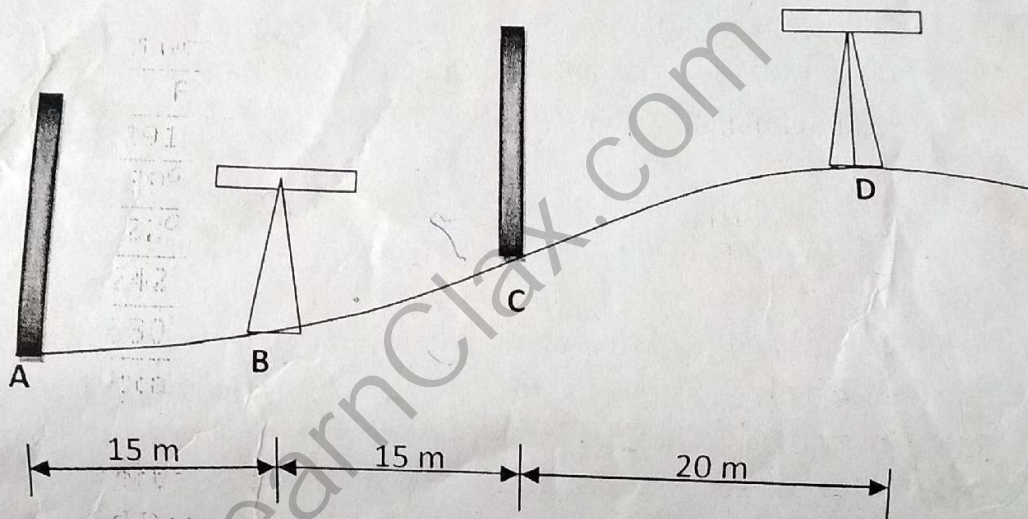


Fig. Q5

(b) The following are staff readings taken during a levelling operation: 1.345, 1.602, 2.125, 0.688, 1.742, 2.625, 1.325, 1.402, 0.685, 2.105, 1.685, 1.155, 1.105, 2.105, 1.085, 1.354, 1.356, 2.107, 2.035, 0.687, 1.625 and 1.415. The instrument was shifted after the 5<sup>th</sup>, 10<sup>th</sup>, 14<sup>th</sup> and 19<sup>th</sup> readings. Arrange the data in a tabular form and find the reduced levels of each of the points if the 12<sup>th</sup> reading was taken to a bench mark of 165.835m. Carry out full checks.

**Question 6:** (a) Show that the Simpson's rule for calculating the areas enclosed between the base line and irregular boundary line is  $A = \frac{h}{3}(F + L + 4E + 2O)$ , where h, F, L and O have their usual meanings. (b) State the differences between Simpson's rule and the trapezoidal rule for computing the areas. (c) The following offsets were taken from a survey line to a curved boundary line

Distance (m)	0	5	10	15	20	30	40	60	80
Offset (m)	2.50	3.80	4.60	5.20	6.10	4.70	5.80	3.90	2.20

Find the area between the survey line and curved boundary line, and the first and the last offset by: (i) The trapezoidal rule and (ii) Simpson's rule