



# MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)

University Examinations for 2013/2014

DEPARTMENT OF COMPUTING AND APPLIED SCIENCE

End of Term Examination for BCE DIPLOMA III

Physical Science

Date:

Time: 2 Hours

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**INSTRUCTIONS:**

- Write your Admission Number in the Answer Booklet
- This paper has two sections, A and B.
- Answer a total of five questions but at least two questions from each section. The fifth question can be chosen from either section.

**SECTION A: MATHEMATICS III.**

Answer at least **two** questions from this section.

- (a) When Kirchhoff's laws are applied simultaneously equations for currents flowing in amperes in various closed loops were obtained such that

$$2i_2 + 5i_3 = -5$$

$$3i_1 + i_2 + 2i_3 = -7$$

$$i_1 + 3i_2 + 4i_3 = 5$$

Determine the value of  $i_1$ ,  $i_2$  and  $i_3$  using crammers rule. (7 marks)

- The electrical resistances of two products are being compared where by a sample size of 40 items from product one has a mean of 74ohms and standard deviation of 8ohms and a sample size of 50 items from product two has a mean of 78ohms and standard deviation of 7ohms. Determine if there is any significant difference between the two products at 0.05 level of significance. (5 marks)

- In an attempt to evaluate the effectiveness of advertisement campaign, a firm compiled the following information

Year	'05	'06	'07	'08	'09	'10	'11	'12
Adv.Expenditure ('000'million)	12	15	15	23	24	38	42	48
Sales ('000'million)	5	5.6	5.8	7.0	7.2	8.8	9.2	9.5

- Find the regression equation of sales on advertisement expenditure.

(ii) Estimate sales when advertisement expenditure is 55000/=. (8 marks)

2. (a) Solve the values of x for which M is a singular matrix

$$M = \begin{pmatrix} x - 3 & 1 & -1 \\ -7 & x + 5 & -1 \\ -6 & 6 & x - 2 \end{pmatrix} \quad (8 \text{ marks})$$

(b) A diameter of a component produced on a semi-automatic machine is known to be normally distributed with a mean of 10mm and standard deviation of 0.1mm. If a random sample of 36 components were picked at random what is the probability that the sample mean will be between 9.95mm and 10.05mm. (4 marks)

(c) Solve for x and y using inverse method given

$$5x + 2y = 14$$

$$3x - 4y = 24$$

(4 marks)

(d) State four methods of random sampling (4 marks)

3. (a) The data below relates to ABC Co. Ltd.

<b>Capital employed (Ksh. '000') y</b>	1, 2, 3, 4, 5, 7, 8, 9, 11, 12
<b>Profits (Ksh. '000') x</b>	3, 5, 4, 7, 9, 8, 10, 11, 12, 14

(i) Determine the Karl Pearson's coefficient of correlation.

(ii) Determine the coefficient of determination and recommend on its value.

(10 marks)

(b) The mean lifetime of a sample of 100 light tubes produced by xyz ltd co. is found to be 1570 hours with a standard deviation of 80 hours. Test the hypothesis that the mean life time of the tubes produced by the company is 1600 hours at 95% level of confidence (4 marks)

(c) In a class of 50 students John scored 63 marks in technical drawing. If the class mean was 59 marks and standard deviation of 7 marks determine:

- i. The number of students who scored above John
- ii. The percentage of students who scored between 40 and 60 marks
- iii. The probability that Mary scored between 51 to 59 marks (6 marks)

4. (a) Given that  $D = \begin{pmatrix} 2 & -1 & 3 \\ -5 & 1 & 0 \\ 4 & -6 & 2 \end{pmatrix}$   $E = \begin{pmatrix} -1 & 3 & 0 \\ 4 & -9 & 2 \\ -5 & 7 & 1 \end{pmatrix}$  and  $B=ED$  Find  $B^{-1}$  (10 marks)

(b) Given the data below

<b>Load (kN)</b>	17, 19, 21, 23, 25, 27, 29, 31
<b>Frequency</b>	9, 23, 55, 78, 64, 28, 14, 4

Determine the Mean and the standard deviation of the distribution and show that the distribution is approximately normal. (10 marks)

### SECTION B: SURVEYING III

Answer at least *two* questions from this section.

5. (a) Outline two systems of tacheometry. (2mks)

(b) Outline the field procedure of determining the tacheometric constants. (8mks)

(c) The table below shows offsets taken from a chain line to an irregular boundary. Compute the area enclosed using;

- (i) Simpsons rule
- (ii) Trapezoidal rule

<b>Chainage (m)</b>	0	20	40	60	80	100	120	140	160
<b>Offset (m)</b>	9.4	10.6	13.6	11.2	9.6	8.4	7.5	6.3	4.6

(10mks)

6. (a) Giving at least two examples in each case, identify three sources of errors encountered in tacheometric surveying. (6mks)

(b) With an aid of a sketch show that the area of a three sided polygon is given as;

$$A = \frac{1}{2} [N_1(E_2 - E_3) + N_2(E_3 - E_1) + N_3(E_1 - E_2)]$$

Where  $(N_1, E_1)$ ,  $(N_2, E_2)$  and  $(N_3, E_3)$  are the coordinates of the parcel of land. (8mks)

(c) Calculate the area of a parcel of land whose corner coordinates are as follows;

<b>Point</b>	<b>N(m)</b>	<b>E(m)</b>
<b>A</b>	1730.00	1580.00
<b>B</b>	1200.00	1930.00
<b>C</b>	940.00	1390.00

(6mks)

7. (a) Define trapezoidal formula for area calculation. (7mks)

(b) A tacheometer with a multiplying constant 100 and additive constant 0.3 was set up at station O and the following results was obtained by keeping the staff vertical. Calculate the horizontal distance between O and P and the reduced level of P.

<b>Point</b>	<b>Staff station</b>	<b>Hair readings</b>	<b>Vertical angle</b>	<b>Remarks</b>
<b>O</b>	BM	1.875, 2.150, 2.425	+6°00'00"11	RL=152.60m
	P	1.650, 1.800, 1.950	-10°30'00"11	--

(13mks)

8. (a) In an operation to determine tacheometric constants  $K$  and  $C$ , an optical theodolite was used. From the principles of stadia tacheometry show that

$$D = KS + C.$$

Use an elaborate sketch.

(7mks)

(b) The following readings were made with a tacheometer fitted with an analytic lens and the constants of the instrument were given as 100 and 0 for multiplying and additive constants respectively.

Instrument station	Staff point	Bearing	Vertical angle	Staff readings		
				Bottom	Middle	Top
P	A	$134^0$	$+10^032^1$	1.360	1.915	2.470
	B	$224^0$	$+5^06^1$	1.065	1.885	2.705

Determine the gradient from point A to B.

(13mks)