



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR BACHELOR OF TECHNOLOGY IN
INFORMATION COMMUNICATION TECHNOLOGY (BTech. ICT)

EIT 4104: FOUNDATIONS OF MATHEMATICS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MAY/JUNE 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are clearly shown

This paper consists of **FOUR** printed pages

Question 1 (Compulsory - 30 Marks)

$$\log_x 4 - \log_4 x = \frac{3}{2}$$

a) Solve for X in the equation (4 marks)

b) If A and B are sets, using Venn diagrams show that $A - B = A \cap B'$ (2 marks)

$$\frac{-5 + 2i}{3 + 4i}$$

c) Find the modulus and argument of (4 marks)

- d) The third term of a G.P is $\frac{5}{4}$ and the sixth term is $\frac{5}{32}$. Determine the first term, the common ratio and sum of the first six terms of the series. (5 marks)

- e) Evaluate $\lim_{n \rightarrow \infty} \left(\frac{n^2 - 2n + 1}{2n^2 + 5} \right)$ (4 marks)

- f) Find the Pearson correlation coefficient for the data below (6 marks)

X	1	3	4	6	8	9	11	14
Y	1	2	4	4	5	7	8	9

- g) Find the derivative of the following function from first principles: $f(x) = \frac{1}{x^2}$ (5 marks)
- Question 2 (20 Marks)**

- a) A hardware store recorded the number of bags of cement sold on 52 Saturdays. The results are as shown below.

58	4	85	47	6	51	40	7	80	7	72	4	81
	7			3			0		3		6	
56	6	63	70	5	76	41	8	75	8	75	7	42
	7			4			1		0		1	
70	7	84	72	5	55	61	8	70	4	40	8	71
	9			4			2		7		4	
66	5	81	66	4	43	87	5	70	6	90	6	76
	9			8			5		0		0	

Prepare a grouped frequency distribution table for the data using a class intervals from 40 – 49,.... To 90 – 99 (3 marks)

- b) The data below shows the reading speed by some 90 adults.

Speed (wpm)	121 – 140	141 – 160	161 – 180	181 – 200	201 – 220	221 – 240	241 – 260	261 – 280	281 – 300
Frequency	2	6	21	26	18	9	4	3	1

- i) Calculate the mean speed (3 marks)
 ii) Calculate the median speed (3 marks)
 iii) Calculate the standard deviation (4 marks)
 iv) State the modal class (1 mark)

c) Compute the rank correlation coefficient for the data below.

X	70	83	90	65	55	75	80	45
Y	120	130	145	110	135	140	95	100

(6 marks)

Question 3 (20 Marks)

a) Let $Z_1 = 2 + i$ and $Z_2 = 3 - 2i$ evaluate $Z_1 + Z_2$ and $\frac{Z_1}{Z_2}$ (4 marks)

b) Express $\frac{1}{2}\sin x - \frac{\sqrt{3}}{2}\cos x$ in the form $r \sin(x + \lambda)$. Determine the value of r and λ , hence solve the equation $\frac{1}{2}\sin x - \frac{\sqrt{3}}{2}\cos x = 1; 0^\circ \leq x \leq 360^\circ$ (8 marks)

c) Given that $\sin A = \frac{4}{5}$ and $\tan B = \frac{5}{12}$, where A is an obtuse angle and B is an acute angle. Find, without using mathematical tables and calculators, the value of $\cos(A - B)$ (5 marks)

d) Show that $\sin x + \cot x \cos x = \operatorname{cosec} x$ (3 marks)

Question 4 (20 Marks)

a) Find the equation of a line perpendicular to the line $2y + 4x - 2 = 0$ and passing through the point (2, 5) (4 marks)

b) The co-ordinates of the vertices of a triangle ABC are $A(-3, -4)$, $B(6, -1)$ and $C(7, 6)$. Find the angle between the lines AB and BC. (4 marks)

c) Find the angle θ between the vectors $\vec{A} = 2i + 4j + 6k$ and $\vec{B} = i - 3j + 2k$ (4 marks)

d) Circle passes through the vertices of a triangle ABC whose sides are 9cm, 8cm and 7cm. Find the radius of the circle. (5 marks)

$$\vec{r}_1 = 2\vec{i} + 4\vec{j} - 5\vec{k} \quad \vec{r}_2 = \vec{i} + 2\vec{j} + 3\vec{k}.$$

- e) Find the vector parallel the resultant of vectors \vec{r}_1 and \vec{r}_2 . (3 marks)

Question 5 (20 Marks)

$$2^{2x-2} + \frac{1}{16^{-(x-1)}} = 320$$

- a) Solve for x in the equation (4 marks)

$$S = \frac{1}{5} + \frac{1}{5^2} + \frac{1}{5^3} + \dots$$

- b) A series is given as $S = \frac{1}{5} + \frac{1}{5^2} + \frac{1}{5^3} + \dots$ confirm that the series converges and find the sum to infinity.

- c) There are three cars, A, B and C in a race. A is twice as likely to win as B while B is twice as likely to win as C. Find the probability that.

- (i) A wins the race
 (ii) Either B or C wins the race (4 marks)

- d) A line with gradient of -3 passes through the points (3, k) and (k, 8). Find the value of k and hence express the equation of the line in the form $ax + by = c$ where a, b and c are constants (4 marks)

$$\frac{\sec^2 \theta - 1}{\sec^2 \theta} = \sin^2 \theta$$

- e) Show that (4 marks)