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
(YR 1 SEM 1)

EIT 4104: FOUNDATIONS OF MATHEMATICS

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: FEBRUARY/MARCH 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
This paper consist of **FOUR** printed pages

QUESTION ONE (30 MARKS)

a) Show that the sum to infinity of a geometric series is $\frac{a}{1-r}$ where a and r are the first term and common ratio respectively provided $|r|$ <1 (2 marks)

b) Find the modulus and argument of $Z = 1 - 2i$ (3 marks)

c) John speaks the truth in 75% and George in 80% of the cases. In what percentage of the cases are they likely to contradict each other in stating the same fact? (4marks)

d) The following data relates to the percentage of unemployment and percentage change in wages over several years.

% unemployment (X)	1.6	2.2	2.3	1.7	1.6	2.1	2.6	1.7	1.5	1.6
% change in wages (Y)	5.0	3.2	2.7	2.1	4.1	2.7	2.9	4.6	3.5	4.4

(I) Calculate the Pearson's product-moment correlation coefficient. (6 marks)

(II) Interpret your result. (1 mark)

e) Solve for y in terms of x if $\log_a\left(\frac{x^2}{y}\right) = 5 - 2\log_a x$ (4 marks)

f) The following table shows the distribution of ages of 150 persons interviewed by a beverage manufacturing company to establish the number of persons in each age group who used the beverage

Age (yrs)	11-20	21-30	31-40	41-50	51-60	61-70	71-80
No. of persons	8	16	30	38	30	18	10

Using this data construct

(I) A histogram (2marks)

(II) An ogive (4 marks)

g) In a geometric series, the first term is a and the common ratio is r. The sum of the first two terms is 12 and the third term is 16.

(I) Determine the ratio $\frac{ar^2}{a+ar}$ (1 mark)

(II) If the first term is larger than the second term, find the value of r. (3 marks)

QUESTION TWO (20 MARKS)

(a) Compute the Spearman's rank correlation coefficient for the data below. (6 marks)

X	68	64	75	50	65	80	76	40	55	64
Y	62	58	68	45	81	60	69	48	50	70

(b) The data below shows the height in cm of pupils in a nursery school class

Height (cm)	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-95
No. of pupils	2	4	6	11	14	5	4	3	1

(I) Calculate the interquartile range (5 marks)

(II) Calculate the variance (3 marks)

(c) Find the equation of the tangent and the normal to the curve $\frac{x^2}{3} + \frac{y^2}{12} = 1$ at the point (1,3) (6 marks)

QUESTION THREE (20 MARKS)

(a) Let $Z_1 = 7 - 2i$ and $Z_2 = -2 - 5i$ evaluate $Z_1 - Z_2$ and $Z_1 Z_2$ (4 marks)

(b) Express $3\sin\theta + 2\cos\theta$ in the form $r\sin(\theta + \lambda)$. Determine the value of r and λ, hence solve the equation $3\sin\theta + 2\cos\theta = 2$ (8 marks)

(c) Solve the equation $2\cos\theta + \sin 2\theta = 0$ for $0^0 \le \theta^0 \le 360^0$ (4 marks)

(d) Show that $\sin 3x = 3\sin x - 4\sin^3 x$ (4 marks)

QUESTION FOUR (20 MARKS)

(a) Find the equation of a line perpendicular to the line $3x - 2y + 2 = 0$ and passes through the point (0,1) (3 marks)

(b) The angle between two lines AB and AC is 45^0. If the co-ordinates of A, B, and C are A(2,-4), B(3, 6) and C (x, y). find the values of x and y (4 marks)

(c) The water supply in a town depends on two pumping stations P and Q. The probability of pump P breaking down is 0.1 and that of pump Q not breaking down is 0.75. Calculate the probability that at least one pump is working. (4 marks)

(d) A triangle ABC has sides AB=8cm, BC=5cm and AC=6cm. Find the three angles of the triangle. (5marks)

(e) If the two vectors $\vec{r}_1 = 2\vec{i} - 3\vec{j} + 5\vec{k}$ and $\vec{r}_2 = 3\vec{i} + a\vec{j} - 2\vec{k}$ are perpendicular,

(I) find the value of a (2 marks)

(II) Evaluate $\left|\vec{r}_2 - \vec{r}_1\right|$ (2 marks)

QUESTION FIVE (20 MARKS)

(a) Given that $P = 3^y$ express $3^{(2y-1)} + 2\times 3^{y-1} = 1$ in terms of P hence or otherwise solve the equation $3^{(2y-1)} + 2\times 3^{y-1} = 1$ (4 marks)

(b) Find the derivative of $y = \frac{1}{x}$ .from first principles. ` (4 marks)

(c) The table below shows the distribution of the marks obtained by some students in the MPUC.

Marks out of 100	40-44	45-49	50-54	55-59	60-64	65-69
No. of students	4	6	12	17	23	8

Calculate:

(I) The median mark (4 marks)
(II) The mode. (2 marks)
(III) The standard deviation (4 marks)

(d) Find the range for the data below and state one disadvantage of using the range as a measure of dispersion. (2marks)

12, 4, 3, 5, 1, 3, 6, 10, 17, 7, 11, 35, 19, 15, 13