THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

SMA 2104: MATHEMATICS FOR SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2011
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- Compulsory (30 MARKS)

(a) If $x = \log_9 5$ and $y = \log_3 5$ find y in terms of x. (5 marks)

(b) The second, fourth and seventh terms of an arithmetic series are the first three consecutive terms of a geometric series. Find:
    (i)   The common ratio (4 marks)
    (ii)   The sum of the first six terms of the geometric series if the common difference of the arithmetic series is 2. (2 marks)

(c) Determine the x and y intercepts and the minimum or maximum of the function $f(x) = 3x^2 - 17x + 10$. Hence sketch the graph of the function $f(x)$ (6 marks)

(d) (i) Find the coefficient of the term $x^2 y^{10}$ in the expansion of $(x+2y)^{12}$ (2 marks)

(ii) Use Binomial expansion up to the fourth term to find the value of $(0.998)^8$

(2 marks)

(e) Given that $\sin A = \dfrac{4}{5}$ and $\tan B = \dfrac{5}{12}$ where A is an obtuse angle and B is an acute angle. Find, $\cos(A+B)$ without using mathematics tables or calculators, (5 marks)

(f) Find the interquartile range for the data:
3, 6, 7, 5, 12, 15, 9, 10, 13. (2 marks)

(g) If $\tan \theta = a$, show that $\dfrac{\cos \theta \sin^2 \theta + \cos^3 \theta}{\sin \theta} = \dfrac{1}{a}$ (2 marks)

QUESTION TWO (20 MARKS)

a) The masses, in grams, of 50 small fruits are as shown in the table blow.

Mass (g)	50-59	60-69	70-79	80-89	90-99	100-109	110-119
No. of fruits	4	5	9	14	7	6	5

   (I)   State the modal frequency. (1 mark)
   (II)   Calculate the variance (4 marks)
   (III)   Calculate the quartile deviation. (5 marks)

b) Bag A contains 2 red balls and 3 blue balls. Bag B contains 3 red balls and 2 blue balls. A bag is picked at random and two balls are drawn from it, one at a time, without replacement.
   i. Represent the information on a tree diagram. (2 marks)
   ii. Find the probability that the balls picked:
   -   Are of the same colour. (2 marks)
   -   Are of different colour (2 marks)

c) The weights, to the nearest kilogram, of heifers in a farm are as shown below.

Weight (kg)	170-179	180-189	190-199	200-209	210-219	220-229
No. of heifers	3	8	13	9	7	5

   Using the data, construct an ogive. (4 marks)

QUESTION THREE (20 MARKS)

(a) Determine whether $(x+2)$ is a factor of the polynomial is $P(x) = x^4 - 7x^2 - 6x$, if so, find the other factors by long division. (5 marks)

(b) Solve the equation $2\cos^2\theta - \sin\theta - 1 = 0$, for $0^0 \le \theta^0 \le 360^0$. (4 marks)

(c) A youth group in a church consists of 10 boys and 5 girls. In how many ways can a football team be formed if:
      (i)   There are no restrictions (2 marks)
      (ii)   The team must have three girls. (3 marks)

(d) Solve the equation $2x^2 - 5x - 6 = 0$ by completing the square. (4 marks)

(e) Rationalize the denominator:
$$\frac{2\sqrt{5}}{\sqrt{5}-3}$$
(2 marks)

QUESTION FOUR (20 MARKS)

(a)   (I) Evaluate $\log_2 5 + \log_2 8 + \log_2 0.2$ (2 marks)

    (II)   If $\log_{10} x = 2.3$ and $\log_{10} y = 3.4$, evaluate $\log_{10}\left(\dfrac{x}{\sqrt{y}}\right)$ (2 marks)

    (III) Find the relationship between a and b that does not involve logarithms if $2\log_3 a + 2\log_3 b = 2$. Find the value of b if $a = 2$ (3 marks)

(b) Solve for X in the equation $27^{2x+2} + 9^{x+1} = 2268$ (4 marks)

(c) Prove that $\dfrac{1-\sin\theta}{\cos\theta} = \dfrac{\cos\theta}{1+\sin\theta}$ (3 marks)

(d) If the roots of $2x^2 + 3x - 4 = 0$ are α and β, without finding the exact values of α and β, find the value of $\alpha^2 + \beta^2$ (3 marks)

(e) Find the radius of a circle that passes through the vertices of a triangle ABC with sides AB=3cm, AC=2.5cm and angle ABC=49^0 (3 marks)

QUESTION FIVE (20 MARKS)

(a) Express $3\sin\theta + 4\cos\theta$ in the form $\gamma\sin(\theta + \alpha)$ giving the values of γ and α hence solve $3\sin\theta + 4\cos\theta - 2 = 0$ for $0^0 \le \theta^0 \le 360^0$ (8 marks)

(b) Show that $\log_b a = \frac{1}{\log_a b}$ (4 marks)

(c) If $\log_b M = 3$ and $\log_b P = 4$, evaluate $\log_b\left(\dfrac{M^{\frac{1}{3}}P^{\frac{1}{4}}}{\sqrt{M^2 P^3}}\right)$ (3 marks)

(d) Find the quadratic function whose vertex is $(3,-2)$ and y-intercept is $(0,4)$ (3 marks)

(e) The data below has a median of 5.5, find X.
    7, 6, 10, 4, 3, X. (2 marks)

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