



# 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  
INDUSTRIAL MICROBIOLOGY & BIOTECHNOLOGY  
YR I, SEM II

SMA 2250: MATHEMATICS FOR BIOLOGISTS

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 **THREE** printed pages

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## **Question 1 (Compulsory - 30 Marks)**

$$\frac{dy}{dx}$$

a) Find  $\frac{dy}{dx}$  from first principles for the following functions

$$y = 7x^4$$

(i)  $y = x \cos x$  (7 marks)

(ii)  $y = x \cos x$  (7 marks)

b) Evaluate.

$$\int_{-1}^1 (2x-1)^2 dx$$

(i) (3 marks)

(ii)  $\int_0^{\frac{\pi}{2}} \cos 3x \, dx$  (3 marks)

c) A biologist is interested in determining the mean daily distance covered by each toad in its search for food. Of a sample of 100 toads observed the mean was 450m with a standard deviation 20m. Find the number of toads likely to cover a distance of:

- (i) Less than 445m (4 marks)
- (ii) Between 430 and 460m (6 marks)

Assume that the distance are normally distributed

**Question 2 (20 Marks)**

$$y = x^3 - 4x^2 + 2$$

- a) (i) Calculate the maximum and minimum values of the function and distinguish between them (9 marks)
- (ii) Sketch the graph of the function in (a)(i) between  $x = -2$  and  $x = +4$  and show the maximum and minimum points clearly on the sketch (5 marks)
- b) When viewed through a microscope a bacterium is seen to move in accordance with the equation  $S = (4t + 6t^2) \times 10^{-6}$

Find:

- (i) The distance travelled between 0 and 45 seconds (2 marks)
- (ii) The velocity after 30 seconds (3 marks)
- (iii) The acceleration after 30 seconds (1 mark)

**Question 3 (20 Marks)**

a) An examination paper consists of 10 questions. The answer to each questions must be selected from four alternatives. If a student guesses the answer to each question, find the probability that he will gain.

- (i) No correct question (3 marks)
- (ii) All correct questions (2 marks)
- (iii) At least 3 correct questions (4 marks)

b) An unbiased die is thrown 600 times. Determine:

- (i) The likely number of times of obtaining a six (2 marks)
- (ii) The probability that the number of times of obtaining a six lies between 105 and 110 times (9 marks)

**Question 4 (20 Marks)**

- a) The acidity of a number of soil samples from a marshy area was determined and the results grouped under class intervals of 0.1 pH as shown in **table 1**.

pH	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
f	2	6	9	15	21	18	12	4	3

Using a suitable assumed mean

- (i) Determine the mean pH of the area (8 marks)  
 (ii) Calculate the standard deviation from the mean of the data (5 marks)
- b) Test at 5% level the hypothesis that the pH of the area in (a) is greater than 6.4 (7 marks)

**Question 5 (20 Marks)**

- a) Differentiate the following functions w.r.t.x

$$y = 4\sec 2(3x^2 + 1)$$

- (i) (6 marks)

$$x \sin y = y \cos x$$

- (ii) (6 marks)

- b) Determine the following integrals

$$\int_1^4 \sqrt{x}(x^2 - 1)dx$$

- (i) (4 marks)

$$\int \frac{1}{6x^2} dx$$

- (ii) (2 marks)

$$\int \frac{2x}{(6x^2 - 3)} dx$$

- (iii) (2 marks)