TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN INDUSTRIAL MICROBIOLOGY & TECHNOLOGY

AMA 4216: MATHEMATICS FOR BIOLOGISTS PAPER 1

END OF SEMESTER EXAMINATION

SERIES: FIRST SEMESTER YEAR ONE

TIME: 2 HOURS

DATE: APRIL 2016

Instructions to Candidates

You should have the following for this examination

-*Answer Booklet, examination pass and student ID*

This paper consists of FIVE questions. Attempt QUESTION ONE and any other TWO.

Do not write on the question paper.

QUESTION ONE (30 MARKS)

a) Differentiate the function $f(x) = 2x^2 + 2$ from first principles (4marks)

b) Differentiate the following with respect to x:

(i) $y = \sqrt{x^2 - 1}$ (2 marks)

(ii) $y = 2\sin x \cos 2x$ (3 marks)

(iii) $y = \frac{x}{\sqrt{(1+x)^2}}$ (3 marks)

c) The mean weight of 500 male students at a certain college is 151 lb and the standard deviation is 15 lb. Assuming the weights are normally distributed, find how many students weigh

(i) between 120 and 155 lb, (b) more than 185 lb. (6 marks)

d) The number of action potentials produced by a nerve, t seconds after a stimulus is given by $N(t) = 25t + \frac{4}{t^2+2} - 2$

Find the rate of action potentials produced by the nerve. (4marks)

e) Evaluate: $\int \frac{2x^3 - 3x}{4x} dx$ (3marks)

f) Sugar is packed in bags by an automatic machine. The mean mass of the contents of a bag is 1.000 kg. Random samples of 36 bags are selected throughout the day and the mean mass of a particular sample is found to be 1.003 kg. If the manufacturer is willing to accept a standard deviation on all bags packed of 0.01 kg and a level of significance of 0.05, above which values the machine must be stopped and adjustments made, determine if, as a result of the sample under test, the machine should be adjusted. (5 marks)

QUESTION TWO (20 MARKS)

a) The relationship between the length L (in metres) and weight W (in Kg) of a species of a species of fish in the Indian Ocean is given by $W = 10.375^3$. The rate of growth in length is given by $\frac{dL}{dx} = 0.36 - 0.18L$, where t is measured in years.

(i) Determine a formula for the rate of growth in weight $\frac{dW}{dt}$ in terms of L.

(3 marks)

b) If a fish weighs 30 kilograms, then approximate its rate of growth in weight using the formula found in (i) above. (4marks)

c) Find the relative maxima and minima of the function; $f(x) = \frac{1}{3}x^3 - x^2 - 3x + 2$.

(7marks)

d) Find dy/dx if $x^2 + 4x - 3y^2 + 4y = 0$ (6 marks)

QUESTION THREE (20MARKS)

a) Integrate the following ;

(i) $(x^2 + 4)^4$ (4 marks)

(ii) $x \cos x^2 dx$ (4 marks)

(iii) $2xe^{x^2}$ dx (4 marks)

b) Suppose the rate of change of the value of a house that cost $ 100,000 can be modeled by;

$$\frac{dV}{dx} = 7.7e^{0.077t}$$

where V is the market value of the home in hundreds of thousands of dollars and t is the time in years since the home was purchased.

(i) Find the function that expresses the value V in terms of t. (4 marks)

(ii) Find the predicted value after 10 years. (4marks)

QUESTION FOUR (20 MARKS)

a) If the mean height of a population of students is $« = 68$ inches with standard deviation $± = 3$ inches .what is the probability that a person chosen at random from the population will be between

(i) 68and 74 inch tall (ii) 65 and 74 inch tall (5 marks)

(iii) less than 70 inch tall (iv) more than 67inch tall (5 marks)

b) Toss a fair coin 100 times, and count the number of heads that appear. Find the mean, variance, and standard deviation of this experiment. (6marks)

c) If a die is rolled 5 times, what is the probability that exactly 2 faces with 4 on them will result . (4marks)

QUESTION FIVE (20 MARKS)

a) The mean life time of a sample of 100 fluorescent light bulbs produced by a company is computed to be 1570 hours with a standard deviation of 120 hours. If « is one mean life time of all bulbs produced by the company, test the hypothesis $« = 1600\ hours$ against the alternative hypothesis $« \neq 1600\ hours$, using a level of significance of 0.05. (7marks)

b) Given $y = 2x - x^2$, determine the approximate change in y , if x changes from 2.50 to 2.51. (5marks)

c) Determine the equations of the tangent and normal to the curve $y = \frac{x^3}{5}$ at the point (-1, -1/5). (8 marks)