TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN INDUSTRIAL MICROBIOLOGY

(BTIM)

AMA 4216: MATHEMATICS FOR BIOLOGISTS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2013

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FOUR** questions

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

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Integrate the following:

(i) $\int \frac{dx}{3x+2}$ **(2 marks)**

(ii) $\int 2(2x-3)^2 dx$ **(3 marks)**

b) Find the derivatives dy/dx of the following functions:

(i) $x = \frac{1}{y^2} - \frac{1}{y}$ **(3 marks)**

(ii) $y = \left(x + x^2\right)^2$ **(4 marks)**

(iii) $f(x) = \frac{x^2 - 7}{2x + 8}$ **(4 marks)**

c) 1000 light bulbs with a mean life of 120 days are installed in new factory and their length of life is normally distributed with standard deviation of 20 days:

(i) How many bulbs will expires in less than 90 days? **(4 marks)**

(ii) How many bulbs will expire in 100 days? **(3 marks)**

(iii) How many bulbs will expire between 80 and 100 days **(3 marks)**

d) Find the equation of the tangent to the curve $y = x^2 - 3x + 2$ at the point where it cuts the y-axis **(4 marks)**

Question Two

a) Find the stationary points and investigate their nature, of the curve $y = x^4 + 4x^3 - 6$ using the second derivative test. **(8 marks)**

b) Find the area:

(i) Between z = 0 and z = 1.5 **(2 marks)**

(ii) To the left of z = 1.93 **(2 marks)**

(iii) To the right of z = 1.11 **(2 marks)**

c) The displacement *x*cm of the slide value of an engine is given by x = 2.2 $\cos 5\pi t + 3.6 \sin 5\pi t$. Evaluate the velocity (in m/s) when time t = 3.0s **(6 marks)**

Question Three

a) Find the equation of the normal to the curve $y = \frac{1}{x}$ at the point on the curve where x = 2 **(5 marks)**

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

$\int (x+3)^{11}\,dx$

c) Evaluate **(4 marks)**

d) Differentiate with respect to x:

$x^2 + xy^2 + y^3 = 2$

(3 marks)

$y = x^4$, $x^2\frac{d^2y}{dx^2} - 12y = 0$

e) If show that , x for all x **(3 marks)**

Question Four

a) An Auto Company decided to introduce a new six cylinder car whose mean petrol consumption is claimed to be lower than that of the existing auto engine. It was found that the mean petrol consumption for 50 cars was 10km per litre with a standard deviation of 3.5km per litre. Test for the company at 5 percent level of significance, the claim that is the new car petrol consumption is 9.5km per litre on the average **(6 marks)**

$x = 5\theta - 1$ $y = 2\theta(\theta - 1)$ $\frac{dy}{dx}$ θ

b) Given and , determine in terms **(4 marks)**

$\int_0^{\frac{\pi}{2}} 3\sin 2x\,dx$

c) Evaluate **(5 marks)**

d) A particle P is moving a long a straight line OX with an acceleration 3t where t is the time in seconds. θ

When t =2, p has a displacement of 4 metres from and a velocity of 7 metres per second. Find:

(i) Velocity as a function of t **(3 marks)**

(ii) Velocity when t = 4 **(2 marks)**

Question Five

$\frac{dy}{dx}$ $x^3 + 3x^2 + xy^2 - 2y^2 = 0$

a) (i) Find from the equation without solving for y in terms of x **(4 marks)**

$\frac{dy}{dx}$

(ii) Evaluate at (1, -2) **(2 marks)**

$\frac{dy}{dx}$ $y = (x+2)^x$

b) Evaluate where x = -1 given . **(6 marks)**

c) The mean height of 500 people is 170ccm and the standard deviation is 9cm. Assuming the heights are normally distributed, determine the number of people likely to have heights:

(i) Between 150cm and 195cm **(5 marks)**

(ii) More than 194cm **(3 marks)**