TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL ENGINEERING

AMA2350: ENGINEERING MATHEMATICS V

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 9 May 2016

<u>**Instructions to Candidates**</u>
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE

a) A function is defined by $f(x) = \begin{cases} x, & 0 \le x \le \pi \\ 0, & \pi \le x \le 2\pi \end{cases}$

   i.   sketch the function for three periods
   ii.   determine the Fourier series for the function
   iii.   taking $x = 0$, deduce a numerical series for the function   (10 marks)

b) 500 tins of paint have a mean content of 1010 ml and the standard deviation of the contents is 8.7 ml. Assuming the volumes of the contents are normally distributed, calculate the number of tins likely to have contents whose volumes are;

   i.   less than 1025 ml
   ii.   less than 1000 ml
   iii.   less than 995 ml   (10 marks)

c) Determine the Fourier half-range sine series for the a function define by
$f(x) = \cos x, \ 0 \le x \le \pi$ (10 marks)

Question TWO

a) A non-periodic function is defined by $f(x) = \begin{cases} x, & 0 \leq x \leq \pi \\ 2\pi - x, & \pi \leq x \leq 2\pi \end{cases}$

    i.   sketch the function for three periods

    ii.   determine the Fourier series for the function   (10 marks)

b)

X	6	3	9	15	2	14	21	13
Y		1.3	0.7	2.0	3.7	0.5	2.9	4.5	2.7

Given the data above, determine

    i.   equation of the regression line of Y on X

    ii.   equation of the regression line of X on Y   (10 marks)

Question THREE

a) The mean diameter of holes produced by a drilling machine bit is 4:05mm and the standard deviation of the diameters is 0:0028mm. For twenty holes drilled using this machine and assuming the diameters are normally distributed, determine, correct to the nearest whole number, the number likely to have diameters;

    i.   between 4.048 and 4.0553 mm

    ii.   between 4.052 and 4.056 mm   (10 marks)

b) A periodic function is defined by $f(x) = \begin{cases} 1 - x, & -\pi \leq x \leq 0 \\ 1 + x, & 0 \leq x \leq \pi \end{cases}$

    i.   sketch the function for two periods

    ii.   determine the Fourier series for the function

    iii. deduce a numerical series for the function   (10 marks)

Question FOUR

a) Given that the probability of rain falling during a particular period is 2/5, determine the probabilities of having 0, 1,2,3, 4, 5,6, and 7 wet days in a week hence present the results on a histogram

        (10 marks)

b) A function f(x) is defined by $f(x) = \begin{cases} -3, & -2 \leq x \leq 0 \\ 3, & 0 \leq x \leq 2 \end{cases}$

    i.   sketch the function for three periods

    ii.   determine the Fourier series for the function   (10 marks)

Question FIVE

a) Determine the half range Fourier cosine series for $f(\theta) = \theta^2$ within the interval $0 \leq x \leq 4$

        (10 marks)

b) In an experiment to determine the relationship between force and momentum, a force, X, is applied to a mass, by placing the mass on an inclined plane, and the time, Y, for the velocity to change from u m/s to v m/s is measured. The results obtained are as follows:

Force (N)	11.4	18.7	11.7	12.3	14.7	18.8	19.6
Time (s)	0.56	0.35	0.55	0.52	0.43	0.34	0.31

Assuming a linear relationship between the quantities determine the equation of the regression line of
i) time on force correct to three significant figures
ii) force on time correct to three decimal places   (10 marks)