TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN MARINE ENGINEERING (DMEN IV)

AMA 2214: ENGINEERING MATHEMATICS IV

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
-   *Answer Booklet*
-   *Mathematical Table*
This paper consist of **FIVE** 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) (i) Solve for n if
$$\frac{(n+1)!}{(n-1)!2!} = 21$$
(3 marks)

(ii) Determine the number of permutations of the letters in the word ENGINEERING.
(2 marks)

(iii) Without using calculators, evaluate $4_{C_2} \times 12_{C4}$
(3 marks)

b) (i) Expand $\left(\frac{x}{2} + 2x^3\right)^4$
(3 marks)

(ii) Expand $(1+x)^{\frac{1}{3}}$ as far as the term in x^3. By putting x = 1/8, determine the value of the cube root of 9 correct to three decimal places
(5 marks)

c) (i) Solve for x if $\sinh x = \frac{3}{4}$
(5 marks)

(ii) A manufacturer produces light bulbs that are packed in boxes of 100. If quality control studies indicate that 0.5% of the light bulbs produced are defective, determine what percentage of the boxes will contain 2 or more defectives:

d) Prove $\tanh^{-1}\left(\frac{x^2-1}{x^2+1}\right) = \ln x$
(6 marks)

Question Two

a) (i) A committee of five members is to be formed from four women and six men. Determine the number of ways this can be done with each committee having at least two women. **(3 marks)**

(ii) Solve for n if $4\binom{n}{2} = \binom{n+2}{3}$
(5 marks)

b) (i) The first four terms in the expansion of $(1+kx)^6$ are $1 + ax + 135x^2 + bx^3$. Determine the values of k, a and b
(6 marks)

(ii) The volume V of a sphere of radius r is given by $V = \frac{4}{3}\pi r^3$. If the error in the measured value of r is 3%, determine using binomial approximation the percentage error in the calculated value of

volume. **(6 marks)**

Question Three

a) (i) Determine the equation of an ellipse in the form $\dfrac{x^2}{M} + \dfrac{y^2}{N} = 1$, if the centre is at the origin, the major axis is along the x-axis and the length of major axis = 50 and length of minor axis = 30. **(4 marks)**

(ii) Sketch the graph $16x^2 + 25y^2 = 400$ **,** and determine the coordinates of the foci and the lengths of the major and minor axes. **(8 marks)**

b) Solve the equation $5\cosh x + 3\sinh x = 4$ **(8 marks)**

Question Four

a) Determine the area under the normal curve in each of following:

   (i) Between z = - 0.68 and z = 0
   (ii) Between z = -0.46 and z = 2.21
   (iii) Between z = 0.81 and z = 1.94 **(8 marks)**

b) The mean inside diameter of a sample of 200 washers produced by a machine is 5.02mm and standard deviation is 0.05mm. The purpose for which these washers are intended allows a maximum tolerance in the diameter of 4.96 to 5.08mm, others the washers are considered defective. Determine the percentage of defective washers produced by the machine, assuming the diameters are normally distributed. **(5 marks)**

c) A machine is known to produce 1% defective components for a production run of 40 components. Calculate the probability that two defectives items are produced.
   (i) Assuming a binomial distribution
   (ii) Assuming a Poisson distribution **(7 marks)**

Question Five

a) If $4e^x + 3e^{-x} = P\sinh x + Q\cosh x$ determine the values of P and Q **(4 marks)**

b) The following table shows how ten students, arranged in alphabetical order, were ranked according to their achievements in both laboratory and lecture portions of certain course. Determine the coefficient of rank correlation:

Laboratory	8	3	9	2	7	10	4	6	1	5
Lecture	9	5	10	1	8	7	3	4	2	6

c) Determine the coefficient of linear correlation (product – moment correlation) between the variables X and Y presented below:

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

(10 marks)