TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN MARINE ENGINEERING (DMAE 3)

EMR 2121: ENGINEERING MATHEMATICS II

END OF SEMESTER EXAMINATION
SERIES: DECEMEBER 2014
TIME ALLOWED: 2 HOURS

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Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
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 **FOUR** printed pages

Question One (Compulsory)

a) The mean of five numbers is 20. The mean of the first three numbers is 16. The fifth number is greater than the fourth by 8. Find the fifth number. **(3 marks)**

b) Point T is the midpoint of a straight lien AB. Given the position vectors of A and T are i – j + k and $2i + \frac{3}{2}k$ respectively. Find the position vector of B in terms of $\vec{i}, \vec{j}\ and\ \vec{k}$ **(3 marks)**

c) Points P(40ºS, 45ºE) and Q(40ºS, 60ºW) are on the surface of the earth. Calculate the shortest distance along a circle of latitude between the two points. **(3 marks)**

d) Given that the matrix $T = \begin{pmatrix} k+5 & -2 \\ 3 & k \end{pmatrix}$ is a singular matrix. Find possible value of K. **(3 marks)**

e) Solve for x $0.893^x = 6.5$ **(3 marks)**

f) A student scored the following marks in an exam. 43, 55, 40, 48, 60, 54, 48, 60, 56 and 74., Determine the median and quartile deviation for the marks. **(4 marks)**

g) Solve $\sin(3x - 30^o) = \frac{\sqrt{3}}{2}$ for $0^o \le x \le 90$ **(3 marks)**

h) Solve for x $\log(x-2) + \log(x+3) = \log 4$ **(3 marks)**

i) The longest side of a right angled triangle is $(9x+2)$. The other two sides are 8x and $(2x+1c)m$ long. Find the area. **(5 marks)**

Question Two

a) Define the following terms:
   (i) Longitude
   (ii) Latitude
   (iii) Great circle
   (iv) Small circle **(5 marks)**

b) Two towns on latitude 30ºS are 3000km apart. Find the longitude difference of the 2 towns.
   ($\pi = \frac{22}{7}$, R = 6370km) **(3 marks)**

c) Calculate the shortest distance between (30ºS, 36ºE) and (30ºS, 144ºW) in nautical miles. **(3 marks)**

d) The position of airport P and Q are P(60°N, 45°W) and Q(60°N, K°E). It takes a plane 5 hours to travel due east from P and Q at an average speed of 600 knots.

    (i) Calculate the value of K   **(3 marks)**

    (ii) The local time at P 10.45am. What is the local time at Q when the plane reaches there.

                                                                                    (3 marks)

e) Find the distance between 2 places P(0°, 30°W) and Q(0°, 20°E) in:

    (i) nm   **(2 marks)**

    (ii) km   **(2 marks)**

(Take R of earth = 6370km)

Question Three

In the figure below AD is the diameter of the circle ABCD with centre 0, radius 10cm. TCS is a tangent to the circle at C. AB=BC and angle DAC = 38°

                                           T

a) Find the size of angle:

    (i) ACD   **(1 mark)**

    (ii) Reflex angle DMA   **(2 marks)**

    (iii) ACS   **(2 marks)**

    (iv) BCA   **(2 marks)**

b) Calculate the length of:

    (i) AC   **(3 marks)**

    (ii) AB   **(3 marks)**

c) At 2.00pm, a ship is at a position P from where a light house L is 12km away on a bearing of 320°. At 4.00pm the ship is at Q from where the light house is, now on a bearing of 035°. Given that the ship is travelling due west, find by calculation.

    (i) How far the lighthouse is from Q   **(3 marks)**

    (ii) The speed of the ship   **(2 marks)**

    (iii) The closest distance of the ship from the light house   **(2 marks)**

Question Four

a) State and explain 2 types of data.   **(3 marks)**

b) Name any FOUR methods of data presentation.   **(2 marks)**

c) The following table shows revenue collected from the sale of fish at the part between 2000 and 2004.

Year	Revenues (in millions)
2000	120
2001	300
2002	280
2003	200
2004	100

   (i) Draw a pie chart to represent the above information.   **(3 marks)**
   (ii) State TWO advantages of using a pie chart to present data.   **(2 marks)**

d) The table below shows marks obtained by 50 students in an exam.

Marks	1 – 10	11 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90	91 – 100
F	2	4	7	6	X	10	2	8	5	3

   (i) Calculate the value of x   **(1 mark)**
   (ii) Using an assumed mean of 55.5 calculate the actual mean and the standard deviation.
                                                                                       (5 marks)
   (iii) Calculate the lower quartile   **(2 marks)**
   (iv) Calculate the 75th percentile   **(2 marks)**

Question Five

a) For a lifting machine, the effort E required to lift the load L is partly a constant and partly varies as L. When L = 2 E = 5.5 and when L = 6 E = 6.5. Determine:
   (i) The equation connecting E and L   **(4 marks)**
   (ii) The effort E when the load is 20   **(2 marks)**

b) Given that A varies directly as B and indirectly as C, find percentage change in A if B is increased by 10% and C increased by 20%.   **(4 marks)**

c) The table below gives the mass and volume of a liquid measured at room temperature.

Mass (g)	8	10	20	21	30	37	52	55	70
Volume (cm^3)	10	13	20	29	35	43	60	63	70

   (i) By plotting the points, draw the line of best fit.   **(5 marks)**
   (ii) Find the density of the liquid   **(2 marks)**
   (iii) Find by extrapolation the mass when the volume is 5cm^3 **(2 marks)**
   (iv) Find by interpolation the volume when the mass is 35g.   **(1 mark)**