## APPLIED MATHEMATICS

## PAPER 2

3hours

# WAKISSHA <br> Uganda Advanced Certificate of Education <br> APPLIED MATHEMATICS 

## Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

- Attempt all questions in section A and any five questions from section B.
- Any additional question(s) answered will not be marked.
- All working must be shown clearly.
- Begin each answer on afresh sheet ofpaper.
- Silent non programmable scientific calculators and mathematical tables with a list offormulae may be used.
- In numerical work, take g to be $9.8 \mathrm{~ms}^{2}$
- State the degree of accuracy at the end of the answer to each question attempted using a calculator or table and indicate Calfor calculator, or Tab for mathematical tables.

Turn Over
SECTION A (40 MARKS)
Answer all questions in this section.
I. Three fair tetrahedral, dice are tossed at once. If $x$ is the number of times the figure 4 appears at the bottom, find the standard deviation of x . ( 5 marks)
2. The able below shows the ex erimental variation of uantities x and y .

| $\mathbf{X}$ | 0.022 | 0.146 | 0.209 | 0.311 |
| :--- | :--- | :---: | :---: | :---: |
| $\mathbf{Y}$ | 14.9834 | 9.0763 | 7.6348 | 4.3131 |

Using linear interpolation or linear extrapolation, find
(i) y when $\mathrm{x}=0.252$, marks)
(ii) x when $\mathrm{y}=2.1473$
3. A taxi accelerates uniformly from rest at $1 \mathrm{~ms}-2$. At the same time, a passenger is 4 m behind the taxi runs with constant speed after the taxi and just manages to catch up with it. Find the speed of the passenger. ( 5 marks)
4. In a certain school, the response time of students to the assembly bells is uniformly distributed with mean 13 minutes and standard deviation Find the probability that a student chosen at random will respond between 8 and 14 minutes after the bell is rung. (5 marks)
5. Study the flow chart below.


Co and com lete the table below.

| EFN | W | BASE |  |
| :---: | ---: | :--- | :--- |
| A21B-03 | 32,000 |  |  |
| D69R-11 | 270,000 |  |  |
| P48M-47 | 84,000 |  |  |
| R29N-14 | 50,000 |  |  |
| L75Q-80 | 100,000 |  |  |

6. A mass of 4 kg in contact with a smooth plane of 5 in 6 is connected by a light inelastic string passing over a smooth light fixed pulley at the top of the plane and under a light moveable pulley carrying a mass of 14 kg . The other end of the string is fixed to a point above the fixed pulley. If the parts of the string supporting the moveable pulley are
parallel and the system is released from rest, find the ${ }^{(i)}$ tension in the string, marks) (ii) acceleration of 14 kg mass. ( 2 marks)
7. Events $A$ and $B$ are such that $P(B)^{-} 20^{\prime} 7 P(\ddot{\mathrm{~A}} / \mathrm{B})-7$ and $2 \mathrm{P}(\mathrm{A})=3 \mathrm{P}(\mathrm{A} \mathrm{n} \mathrm{G})$. Find;
(i) $\mathrm{P}(\mathrm{AnB}), \quad$ (3 marks)
(ii) $\mathrm{P}(\mathrm{A}) .(2$ marks $)$
8. A body of mass 0.5 kg is suspended from a fixed point A by a light elastic string of natural length 4 cm and modulus of elasticity 19.6 N . The particle is pulled vertically downwards to a point d cm below equilibrium position and released. If it just reaches the level of A, calculate the ${ }^{\text {(i) }}$ value of $d$, (3 marks)
(ii) kinetic energy of the particle when it passes the equilibrium position for the first time. (2 marks)

## SECTION B (60 marks)

Attempt any five questions from this section.
9. Find the consecutive integers within which the root of the equation $x^{3}+4 x 2 \quad 16$ $=0$ lies. Use Newton-Raphson Method to find the root of the equation correct to four decimal places. (12 marks)
10. (a) The probability that a marksman aims and hits a target with a single shot is 0.4 . If the marksman is given 25 bullets, find the probability that he
hits the target:
(1) exactly 8 times,

```(5
marks)
(ii) between 9 and 15 times inclusive.
(b) A company packs salt in bags which are normally distributed with mean weight 50 kg and variance \(9(\mathrm{~kg})^{2}\). A random sample of 20 bags was taken.
Find the probability that the sample mean lies between 49 and 50.5 kg .
(1 mark)
I 1. A square ABCD of side 4 m has forces of magnitude \(8 \mathrm{~N}, 3 \mathrm{~N}, 3 \mathrm{~N}, 4 \mathrm{~N}\) and

202 N acting along \(\mathrm{AB}, \mathrm{CB}, \mathrm{DA}, \mathrm{CD}\) and BD respectively. Taking AB and AD as x and y axes respectively,
(a) find the distance from A where the line of action of the resultant crosses

\section*{AB.}
(b) When a couple of magnitude M is introduced, the force system is reduced to a single force passing through B. Find \(M\) and its direction.
12. The able below shows the distribution of marks of students in a test.
\begin{tabular}{|c|c|}
\hline Score & Frequency \\
\hline \(20 \leq x<30\) & 4 \\
\hline\(x<45\) & 3 \\
\hline\(x<50\) & 9 \\
\hline\(x<65\) & 21 \\
\hline\(x<75\) & 3 \\
\hline\(x<80\) & 5 \\
\hline\(x<100\) & 14 \\
\hline
\end{tabular}
(a) Draw a histogram and use it to estimate the modal
mark.
(b) Calculate the;
(i) mean
score, (ii)
standard
score, (iii)
median
score.
13. The exact numbers A and B have been estimated by a and b respectively. Given that EA and EB are the corresponding errors,
(a) Show that the absolute error in B given by PI 1B I ) Hence deduce the expression for error in -C
(b) The numbers a \(4.314, \mathrm{~b}=18.92\) and c 15.0214 are each rounded off to the given number of decimal places. Use the expression in (a) to find the range of values within which the exact lies correct to four decimal
places.
14. (a) A train of mass \(250,000 \mathrm{~kg}\) starts from rest and moves along a straight level track against resistance of \(0.06 \mathrm{Nkg}-\mathrm{l}\).
(i) Find the driving force of the train if it attains a velocity of \(40 \mathrm{~ms}-1\)

5
after - minutes.
(5 marks)
3
(ii) Calculate the power necessary to drive the train at a constant speed of \(15 \mathrm{~ms}-\mathrm{up}\) an incline of I in 200.
(b) A particle of mass 0.5 kg is projected with kinetic energy of 750 J up a plane inclined at \(45{ }^{0}\) above the horizontal. If the coefficient of friction is 0.25 , find the work done against frictional force before the particle comes to rest. (5 marks)
15. The distribution function of a random variable \(x\) is represented graphically as shown.


Find the;
(i) value of k ,
\[
\mathrm{P}((x>-1) /(-1.5<x<1))
\]
(12 marks) 16. Two equal uniform rods AB and BC , each 2 m long and masses 10 kg and 14 kg respectively are freely hinged together at B and hang freely from the point A . A horizontal force F acting at C maintains equilibrium when the rod BC makes an angle of \(60^{\circ}\) with the downward vertical. Find the:
(i) value of F ,
(ii) magnitude of reaction at A ,
(iii) angle that AB makes with the vertical.

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