P425/2

APPLIED MATHEMATICS

PAPER 2

July/August, 2023

3 Hours

ASSHU ANKOLE JOINT MOCK EXAMINATIONS 2023

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 Hours

INSTRUCTIONS TO CANDIDATES

- Answer all the **eight** questions in section A and any **five** questions from section B.
- Any additional questions answered will **not** be marked.
- All necessary working **must** be shown clearly.
- Any number on graphical work should fully be attempted on the graph paper provided.
- Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.
- In numerical work, take acceleration due to gravity (g) to be $9.8ms^{-2}$.

SECTION A (40 MARKS)

Answer all the questions in this section

1. A certain farm had $\frac{2}{3}$ of the seeds treated to improve germination and of these the probability of germinating is 0.9, whereas the untreated seeds have a probability of not germinating of 0.4, determine the probability that the seeds

   (a) germinate

   (b) treated, given that if germinated.   (05 marks)

2. A particle is projected with a velocity of 5i ms^{-1} from the origin O and passes through a point P which has position vector (xi + 80j) m. Taking 10ms^{-2} determine the;

   (a) time taken to reach P from O,

   (b) value of x.   (05 marks)

3. The number $x = 4, y = 16.2$ and $z = 2.53$ are rounded off with corresponding errors of 0.5, 0.06 and 0.007, determine the absolute error in $\frac{xy}{z}$.

4. A biased coin in such that the ratio of the head to a tail is 2:1, if it's tossed six times, determine the probability that;

   (a) at least 5 heads occur.

   (b) at most 1 tail occur.   (05 marks)

5. An equilateral triangle of side each 4m and forces each of 10N act along the sides $\overrightarrow{AB}, \overrightarrow{BC}$ and$\overrightarrow{CA}$, taking $\overrightarrow{AB}$ as the x-axis show that the resultant is a couple.   (05 marks)

6. A certain experiment showing a variation of temperature with respect to time as indicated below.

Temperature(°C)	90	75	60	40	25
Time(s)	50	100	150	200	250

   Using linear interpolation or extrapolation estimate;

   (a) Temperature corresponding to time = 170s

   (b) Time corresponding to temperature = 100°c.   (05 marks)

7. A discrete random variable x has cumulative distribution

x	3	4	5	6	7
F(x)	0.01	0.23	0.64	0.85	1

Determine the

(a) Mean E(x)

(b) Var(x)   (05 marks)

8. A car of mass 900kg ascends a slope inclined at θ where $\sin \theta = \frac{1}{30}$ when the engine is working at a rate of 19.2kw with a speed of 10ms^{-1} and the resistance of 360N. Determine the acceleration of the car.
                                                                          (05 marks)

SECTION B (60 MARKS)

Answer any five questions from this section

All questions carry equal marks

9. A continuous random variable x is uniformly distributed in the interval a<x<b. the lower quartile is 5 and upper quartile is 9. Determine the

   (a) values of a and b,

   (b) P(4<x<7),

   (c) mean E(x) and var(x).   (12 marks)

10. At noon ship A is sailing due east at a constant velocity of 20kmhr^{-1}. At the same time ship B is sailing in the direction N60°E at a constant velocity of 15kmhr^{-1}. If B is due south of A at a distance of 30km. if they continue sailing with these velocities in these directions, determine the

    (a) time at shortest distance,

    (b) shortest distance.   (12 marks)

11. (a) Use the trapezium rule with six sub-intervals to estimate $\int_{1}^{6} x \ln x \, dx$, correct to 3 decimal places.

    (b) Find the exact value correct it to 3 decimal places hence find the absolute error and percentage error and state how the error may be reduced.   (12 marks)

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12. The data below represents the mathematics grade(y) and their respective intelligence test score(x) for 10 students of a certain school.

Intelligence test score (x)	78	66	73	75	84	66	89	84	67	77
Mathematics grade(y)	81	68	81	75	80	67	85	83	66	78

   (a) (i) Construct a scatter diagram, draw the line of best fit and comment.
       (ii) Estimate y, when x=80
   (b) Calculate the rank correlation co-efficient and comment at 5% level of significance. (12 marks)

13. A particle is moving so that at any instant its velocity vector (V) is given by $V=3ti - 4tj + t^2k$. when $t = 0$ it is at the position $(1,0,1)$m, determine the

   (a) displacement at t=2s and hence the distance,

   (b) acceleration at t= 3s and its magnitude,

   (c) hence force at t = 3s when the mass of the particle is 3kgs in vector form. (12 marks)

14. (a) On the same graph show that $y = e^{-x}$ and $y = \sin x$ have a root(x) between x=0 and x=1, correct it to 1 decimal place.

   (b) Using the initial approximation of the root (x_o) and the Newton Raphson method find the root correct it to 3 decimal places. (12 marks)

15. A factory produces bars of soap. Their weight are normally distributed such that 5% weigh more than 210 grams and 1% weigh less than 185 grams, determine the;
   (a) mean and standard deviation.
   (b) probability that the weights lie between 182 and 195 grams. (12 marks)

16. A uniform rod AB of weight 40N and length 8m is smoothly hinged at A and has a particle of weight 60N attached to it at B. a light inextensible string is attached to the rod at point C, where AC=5.5m and to a point D vertically above A that keeps the rod in a horizontal position. If the angle between the rod and the string is 30°, determine the;

   (a) tension in the string.

   (b) magnitude and direction of the reaction at the hinge. (12 marks)

END