UGANDA ADVANCED CERTIFICATE OF EDUCATION PRE – REGISTRATION EXAMINATIONS 2016 APPLIED MATHEMATICS PAPER 2 TIME: 3HOURS

Instructions

Attempt all the questions from Section A and any FIVE from Section B. For numerical work, take $g = 9.8 \text{ms}^{-2}$

SECTION A: (40MARKS)

- 1. A fair die is tossed thrice. Find the median and the most likely number of heads obtained.
- 2. A particle moves in a straight line and when its distance from a fixed point O is x metres, its retardation is $(5 + \frac{1}{2}x)ms^{-2}$. Given that its velocity is 20ms⁻¹ when x = 0. Find the value of x when the particle first comes to rest.
- 3. The resultant force acting on a vehicle was recorded after every 5 seconds as 740N, 590N, 460N and 360N. Given that initially the force acting was 800N, estimate;
 - i) The force acting after 12s
 - ii) The time when the force is 300N.
- 4. The resultant of two forces XN and 3N is 7N. If the 3N force is reversed, the resultant is $\sqrt{19}$ N. Find the value of X and the angle between the two forces.
- 5. In a certain school, students are allocated houses namely Kizito (K), Kibuka (Kb), Mugaga (Mu), Mbaga (Mb) and Charles(C) in the ratio 30%, 15%, 10%, 10% and 35% respectively on admission. Each house has an estimated ratio of girls of 5%, 2%, 3%, 4% and 1% respectively. If the sports master randomly picks a student at random from the school;
- a) What is the probability that the student is a girl?
- b) Given that the student is a girl, what is the probability that she belongs to Kibuka House?

6. A continuous random variable X has the distribution function

$$f(x) = \begin{cases} 3kx\left(1 - \frac{x^2}{3}\right) & 0 \le x \le 1, \\ 1 & x > 1 \end{cases}$$
 Determine;

i) The value of k

- ii) Probability density function of x.
- 7. The table below shows the order in which ten candidates were ranked in an aptitude test.

Position	1 st	2^{nd}	3 rd	4 th	5 th	6 th	7^{th}	8 th	9 th	10^{th}
Test 1	А	F	D	С	Η	J	Κ	В	Е	L
Test 2	D	F	С	Α	J	K	Η	В	L	E

Calculate the rank correlation coefficient between tests 1 and 2. Hence comment on your result at a 5% level.

8. A box of mass 6kg is placed on a rough plane inclined at 45° to the horizontal. The coefficient of friction between the box and the plane is 0.5. Find the magnitude of the horizontal force that must be applied to the box so that it moves up the plane with an acceleration of $2\sqrt{2}ms^{-2}$.

SECTION B (60MARKS)

- 9. A car of mass 800kg is towing a trailer of mass 150kg on a level road frictional resistance to each vehicle amounts to 7N per kg of mass.
- a) Calculate the tension in the tow bar when the vehicles are travelling at a constant speed.
- b) The car and the trailer now climb a straight slope of inclination 1 in 20. If the frictional resistance are the same as before and the power of the engine is 50KW, calculate
- i) The maximum speed up the slope
- ii) The acceleration when the speed is 54kmh⁻¹
- 10. The probability distribution of a discrete random variable X is given by

$$P(X = x) = \begin{cases} k(n - x): x = 1, 2, 3, \dots n \\ 0: otherwise \end{cases}$$

a) Find k in terms of n



- b) Show that the expectation of X and the variance of X are given by $\frac{1}{3}(n+1)$ and $\frac{1}{18}(n+1)(n-2)$ respectively.
- c) If n = 5, construct the probability distribution of X. Hence sketch P(X = x).
- 11. The heights of 250 students were recorded in a survey as below.

Height (cm)	170-	175-	180-	185-	190-	195-<200
No of	19	36	70	64	39	22
students						

- a) Calculate the mean and the modal height.
- b) Plot a cumulative frequency curve to represent the data and use it to estimate;
 - i) The median height
 - ii) The standard deviation
 - iii) 70th percentile
- 12. A car A is travelling at a constant velocity of 20kmh⁻¹ due East and a cyclist B is travelling with a velocity of 16kmh⁻¹ in the direction of the vector (-4i + 3j). At noon A is 1.2km due North of B.
- a) Obtain an expression for the position vector of A and B at time *t* hours past noon.
- b) Find the position vector of A relative to B.
- c) Deduce that, if dkm is the distance between A and B, then $25d^2 = 36(100t^2 16t + 1)$. Hence show that the minimum separation between A and B is 720m and find the time at which this occurs.
- 13. Forces of magnitude 5N, 4N, 7N, 2N and 8N act along the directions PQ, QR, SR, SP and PR respectively of a rectangle PQRS whose length is 6b and width 3b. The direction of the force being indirected by the order of the letters.
- a) Find the magnitude and direction of the resultant of the forces.
- b) Show that the line of action of the resultant force cuts PQ at a distance $\frac{1}{2}b$ from P.
- 14. The marks of 500 candidates in an examination are normally distributed with mean 45 marks and standard deviation 20marks.
- i) Given that the pass mark is 41, estimate the number of candidates who passed the examination.
- ii) If 5% of the candidates obtain a distribution by scoring x marks or more, estimate the value of x.

iii) Estimate the interquartile range of the distribution.

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