RESOURCEFUL MOCK 2017

Uganda Advanced Certificate of Education APPLIED MATHEMATICS TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

- Attempt **all** the questions in section **A** and only **five** questions from section **B**
- Any additional question(s) answered will not be marked
- In numerical work, take g to be 9.8ms⁻²

SECTION A

- 1. Two events A and B are such that P (A' \cap B') = x, and P (B) = $\frac{4}{7}$. Using a Venn diagram, find the values of;
 - i) x
 - ii) P (A∩B)
- 2. Particle A of mass 2kg moves under the action of three forces, F_1 , F_2 and F_3 at a time t,

$$F_1 = (\frac{1}{4}t - 1)i + (t - 3)j N$$

$$F_2 = (\frac{1}{2} + 2)i + (\frac{1}{2}t - 4)j N$$

$$F_3 = (\frac{1}{4}t - 4)i + (\frac{3}{2}t + 1)j N$$

 $F_3 = (\frac{1}{4}t - 4)i + (\frac{3}{2}t + 1)jN$, find the acceleration of the particle when t = 2 seconds.

- 3. A body of mass 8kg rests on a rough plane inclined at Θ to the horizontal. If the coefficient of friction is μ , find the least horizontal force in terms of μ , Θ and g which will hold the body in equilibrium.
- 4. The random variable X has a probability function

$$f(x) = \begin{cases} K2^{x} ; & x = 0, 1, 2, 3 \\ 0 & \text{elsewhere} \end{cases}$$

Find;

- a. The value of the constant K
- b. E (x)
- 5. a) Show that the final velocity V of a body which starts with an initial velocity U and moves with uniform acceleration a consequently covering a distance x, is given by

$$W = (u^2 + 2ax)^{\frac{1}{2}}$$

b) Find the value of X in each if V = 30ms^{-1} , U = 10ms^{-1} and a = 5ms^{-2}

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6. Find the approximate value, to one decimal place of $\int_0^1 \frac{dx}{1+x}$, using the trapezium rule with five strips. [5mks]

t	0	0.3	0.6	1.2	1.8
f (t)	2.72	3.00	3.32	4.06	4.98

7. The table below shows the values of a continuous function f with respect to t

Using linear interpolation find;

a.	f (t) when t = 0.9	[3mks]
b.	t when f(t) = 4.48	[2mks]

8. Show that the equation $f(x) = x^3 + 3x - 9$ has a root between x = 1 and x = 2. Using the Newton Raphson formula once, estimate the root of the equation rounded off to two significant figures. [5mks]

SECTION B

9. a) A block of wood of mass 0.52kg, is at rest on a smooth horizontal table. A bullet of mass 0.08kg is moving with horizontal speed of 30ms⁻¹. The bullet strikes the block and becomes embedded in it. Find the speed of the block after impact.

b) Two bodies A and B have masses of 3kg and 4kg respectively. When A is moving with a velocity of $(5i - 6j) ms^{-1}$, it collides with B whose velocity is $(2i+3j)ms^{-1}$. Immediately after collision the velocity of B is $5i ms^{-1}$. Find the;

i) Velocity of A after the collision

ii) Loss in kinetic energy due to collision

- 10. a) A body of mass mkg lies on a rough plane inclined at θ^0 to the horizontal, when a force of $\frac{mg}{2}$ N parallel to and up the plane is applied to the body, it is just about to move up the plane. When a force of $\frac{mg}{4}$ N parallel to and down the plane is applied to the body, it is just about to move down the plane. Calculate correct to two decimal places the value of;
 - i) θ
 - ii) The coefficient of friction between the body and the plane.
- 11. a) A random variable X has the probability density function.

 $f(x) = \begin{cases} \frac{2}{3a}(X+a); & -a \le x \le 0\\ \frac{1}{3a}(2a-x); & 0 \le x \le 2a\\ 0 & \text{elsewhere} \end{cases}$

Where a is a constant

Determine

- i) The value of a
- ii) The median of X
- iii) P(x < 1.5)/(x > 0)
- iv) The cumulative distribution function F (x), sketch the graph of F (x).
- 12. a) Two particles are moving towards each other, along a straight line. The first particle has a mass of 0.2kg and moving with a velocity of 4ms⁻¹, and the second has a mass of a 0.4kg moving with a velocity of 3ms⁻¹. On collision, the first particle reverses its direction and moves with a velocity of 2.5ms⁻¹. Find the;
 - i. Velocity of the second particle after collision
 - ii. Percentage less in kinetic energy

b) The diagram shows particle A of mass 0.5kg attached to one end of a light inextensible string passing over a fixed pulley and under a movable light pulleyB. The end of the string is fixed as shown below;



- i. What mass should be attached at B for the system to be in equilibrium?
- ii. If B is 0.8kg, what are the accelerations of particle A and pulley B?
- 13. Forces of magnitude 3N, 4N, 4N, 3N and 5N act along the lines AB, BC, CD, DA and AC respectively, of the square ABCD whose side has a length of a units. The direction of the forces are indicated by the order of the letters.
 - a. Find the magnitude and direction of the resultant force
 - b. If the line of action of the resultant force cuts AB produced at E, find the length AE.
- 14. a) The numbers X and Y were estimated within maximum possible errors of ΔX and ΔY respectively. Show that the percentage relative error in XY is

$$\left(\frac{\Delta X}{X} + \frac{\Delta Y}{Y}\right) x \ 100$$
 [5mks]

b) Obtain the range of values within the exact value of 3.551 x 2.71635 lies. [04]

c) Locate each of the three roots of the equation $x^3 - 5x^2 + 5 = 0$ [3mks]

15. a) Use a graphical method to find a first approximation to the real root of $x^3 - 3x + 4 = 0$

b) Use the Newton –Raphson method to find the root of the equation correct to 2 decimal places. [12mks]

16. a) Bag A contains 2 green and 2 blue balls, while bag B contains 2 green and 3 blue balls. A bag is selected at random and two balls drawn from it without replacement. Find the probability that the balls drawn are of different colours.

[6mks]

b) A fair die is rolled 6 times. Calculate the probability that;

- i. a 2 or 4 appears on the first throw,
- ii. four 5s will appear in the six throws [6mks]

END