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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

Bachelor of Science in Applied Sciences

FirstYear- Semester II Examination – Jan/Feb 2023

MAA 1104 – MATHEMATICAL MODELLING

Answer **All questions.** Time: **One (01) hour**

1.

a) The population of elk in a national forest was measured to be 12,000 in 2003 and was measured again to be 15,000 in 2007. If the population continues to grow linearly at this rate, what will the elk population be in 2023?

(25 marks)

b) A friend is using the equation $P_n = 4600\ (1.072)^n$to predict the annual tuition at a local college. She says the formula is based on years after 2010. What does this equation tell us?

(25 marks)

c) In 1990, the residential energy use in the US was responsible for 962 million metric tons of carbon dioxide emissions. By the year 2000, that number had risen to 1182 million metric tons. If the emissions grow exponentially and continue at the same rate, what will the emissions grow to by 2050?

(25 marks)

d) The US's home energy use contributed to 962 million metric tons of carbon dioxide emissions in 1990. This amount had increased to 1182 million metric tons by the year 2000. What will the emissions be by 2050 if the emissions increase exponentially and keep increasing at the same rate?

(25 marks)

2.

a) A motorboat goes upstream on a river and covers the distance between two towns on the riverbank in six hours. It covers this distance downstream in five hours. If the speed of the stream is 2 km/h, find the speed of the boat in still water.

(25 marks)

b) Suppose Amara has invested ` 15,000 at 8% simple interest per year. With the return from the investment, he wants to buy a washing machine that costs ` 19,000. For what period should he invest ` 15,000 so that he has enough money to buy a washing machine?

(25 marks)

e) A farmer is looking to divide to plant different cultures. Traditionally, corn fields returned $3.50 per square meter. Oat fields returned $2.75 per square meter. Orchards produced revenues of $4.50 per square meter. The farmer has a land area of 1 million square meters. In order to feed his farm animals, the cultivator must dedicate a minimum of 300,000 square meters to the culture of corn and oats (together). He does not want this culture to cover more than 200 000 square meters, however, because corn is more susceptible to long periods of drought. Lastly, he would like to allot the same amount of space to oats and orchards. Which expression correctly represents the revenues of the farmer? Make a model of all the restrictions the farmer needs to follow.

(50 marks)

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