Date:

Registration number:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27

UG - II SEMESTER

SEMESTER EXAMINATION: APRIL 2022

(Examination conducted in July 2022)

MTOE 3 – MATHEMATICS FOR BIOLOGISTS

Time- 2 hrs Max Marks-60

This question paper contains TWO printed pages and TWO parts

Part A

Answer any 10 questions **10× 2=20 marks**

1. Rick's car gets 29.7 miles per gallon on the highway. If the car's fuel tank holds a maximum of 10.45 gallons, then how far can he travel on one full tank of fuel?
2. If 40% of a number is equal to two-third of another number, what is the ratio of the first number to the second number?
3. A conical ant heap has a base area of 0.65 m^2 and a height of 0.24 m. What volume does the ant heap occupy?
4. Draw the graph from the table

x	1	2	3	4	5	6	7
f(x)	100	300	500	700	900	1100	1300

5. Find the second derivative of the function $f(x) = \frac{1}{x^{-2}}$.
6. Derive the formula for the rate of a first order reaction.
7. Define a function and give an example.
8. Find the n^{th} derivative of the function $y = e^{-x}$.
9. How many 4 digit numbers can be formed using the digits (1, 3, 4, 5, 7, 9) when repetition of digits is not allowed?
10. The following scores were obtained in a statistics exam:

74	80	65	85	95	72	76	72	93	84
75	75	60	74	75	63	78	87	90	70

Find the frequency distribution when the data are classified into four classes: 60-70, 70-80, 80-90, 90-100.

11. Find the sample mean and median for the data: 8 , 7, 12, 5, 6, 7, 4
12. A family has six children. Find the probability P that there are: three boys and three girls. Assume that the probability of any particular child being a boy is $\frac{1}{2}$.

Part B

Answer any 8 questions **8× 5=40 marks**

1. i) The traffic lights at three different road crossings change after every 48 sec, 72 sec and 108 sec respectively. If they all change simultaneously at 8:20:00 hrs, when will they again change simultaneously ?

   ii) In a public library 10% of the books are Science books. If there are 90,000 books in the library, find the number of Science books available.

   (3+2marks)

2. i) The sum of three numbers is 98. If the ratio of the first to second is 2 :3 and that of the second to the third is 5 : 8, then find the second number.
   ii) If a car takes 24 minutes to cover 15 km, how long will it take to travel 10 km.
   (3+2marks)
3. Solve the system of linear equations
$$2x + 8y + 4z = 2$$
$$2x + 5y + z = 5$$
$$4x + 10y - z = 1$$
4. Draw the graph of the function $f(x) = \frac{3x-7}{15}$ $where$ $-3 \leq x \leq 3$.
5. Find the first derivative of $f(x) = \frac{x^2+3x-9}{x^3+1}$
6. Find the critical points and determine the maxima and minima of the function $f(x) = \frac{x^2+16}{x}$.
7. A first order reaction has a rate constant $1.15\ 10^{-3}s^{-1}$. How long will 5g of this reactant take to reduce to 3g?
8. A slow economy caused a company's annual revenues to drop from Rs 5,30,000 in 2008 to 3,86,000 in 2010. If the revenue is following an exponential pattern of decline, what is the expected revenue in 2012?
9. During a 30-day period, the daily number of station wagons rented by an automobile rental agency was as follows:

7	10	6	7	9	4	7	9	9	8	5	5	7	8	4
6	9	7	12	7	9	10	4	7	5	9	8	9	5	7

   i) Find its frequency and cumulative frequency distribution.
   ii) Display the frequency distribution in a histogram. (3+2marks)

10. Suppose 20 percent of the items produced by a factory are defective. Suppose 4 items are chosen at random. Find the probability that:
    i) 2 are defective
    ii) none are defective (3+2marks)

11. Suppose 95% of students are between 1.1m and 1.7m tall. Assuming the heights of students are distributed normally, compute the mean and standard deviation of the data.