MIE-MPI – EXAM				January 12, 2022

Name	Q1–6	Q7	Q8	Q9	Σ

Multiple choice question answer table					
Q1	Q2	Q3	Q4	Q5	Q6

Instructions: Questions 1 to 6 have possible answers labelled A–E. There is always exactly one correct answer. Please, use the table above to mark your answer. If you make a mistake, correct your answer in the table (in a readable manner).

Other questions serve as a preparation for the oral part of the exam (nevertheless, your written preparation should be understandable). Don't forget to sign this sheet and all the sheets that you will hand in.

*You can use only paper, pen and **your** brain! Good luck!*

Question 1 (5 points). How many generators has the group $\mathbb{Z}_{29}^{\times}$?

(A) 7.

(B) 10.

(C) 12.

(D) 19.

(E) 28.

Question 2 (5 points). What is the value of the second derivative with respect to y of the function $f(x,y) = \sqrt{x} - x^2 y + \ln y$ at the point $(1, 2)$?

(A) 0.

(B) -2.

(C) $-\frac{1}{4}$.

(D) $-\frac{1}{2}$.

(E) None of the above values.

Question 3 (5 points). In the field $GF(3^3)$ with multiplication modulo $x^3 + x^2 + x + 2$, find the results of $011 \cdot (101 - 020)$.

(A) 421

(B) 112

(C) 101

(D) 02

(E) None of the above option.

Question 4 (5 points)**.** Let us consider the permutation $f = (2\,3\,5\,4\,8\,7\,6\,1) \in S_8$. The permutation f^{21} is

(A) $(2\,3\,5\,4\,8\,7\,6\,1)$

(B) $(1\,2\,3\,4\,5\,6\,7\,8)$

(C) $(3\,5\,8\,4\,1\,6\,7\,2)$

(D) $(5\,8\,1\,4\,2\,7\,6\,3)$.

(E) None of the above permutations.

Question 5 (5 points)**.** Let us consider as domain D the finite region delimited by the graph $y = 1 - x^2$, the x-axis and the y-axis in the first quadrant (that is, $x \geq 0$ and $y \geq 0$). Select the value of the double integral

$$\iint_D x + y \ \mathrm{d}x\mathrm{d}y.$$

(A) 8

(B) $\frac{31}{60}$

(C) $\frac{7}{4}$

(D) -4

(E) None of the above values.

Question 6 (5 points)**.** Let $n \in \mathbb{N}$ and M be the set of regular $n-$square matrices with classical matrix addition and matrix multiplication.

(A) $(M, \cdot)$ is a group.

(B) $(M, \cdot)$ is a ring.

(C) $(M, +, \cdot)$ is ring but not a field.

(D) $(M, +, \cdot)$ is a field.

(E) None of the above is true.

Question 7. (10 points) Let $f : \mathbb{R}^3 \to \mathbb{R}$ and $(x, y, z) \in \mathbb{R}^3$. List sufficient conditions for (x, y, z) to be

(a) a saddle point;

(b) a point of local strict minimum;

(c) a point of local strict maximum.

Question 8. (10 points)

1. Write down the definition of t-norm.

2. Give an example of t-norm.

3. How can we use t-norms in fuzzy logic?

Question 9. (10 points)

1. Write down the definition of ring and field.

2. Is it possible to construct fields of any order? Justify your answer.