الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
TMATH-II: TECHNICAL MATH 2
Spring 2026

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration: 2.5 hours
Instructor's Name: Dr. Rokhsaneh Yousef Zehi
Exam Date: 13/05/2026
Program: PE

	40
	10

Student Information

Name: ID:

Signature:

Invigilator

Initials: ☐ Student ID checked

Time received:

Question 1 **[5 marks]**

A tank initially contains pure water. A salt solution with concentration $150\ mg/L$ flows into the tank at a constant rate, and the mixture flows out at the same rate, so the volume remains constant. The concentration $C(t)$ (in mg/L) in the tank satisfies the following differential equation:

$$\frac{dC}{dt} + \frac{Q}{V}C = 150\frac{Q}{V}$$

where $Q = 10\ L/s$ and $V = 500\ L$.

a. Determine the general solution for $C(t)$. (4 marks)

b. Determine a particular solution for $C(t)$ if $C(0) = 0$. (0.5 marks)

c. Determine the concentration after 40 seconds. (0.5 marks)

Question 2 **[8 marks]**

A RLC series circuit contains a resistor, an inductor, and a capacitor connected to a voltage source $E(t) = 10\cos t$. If $I(t)$ is the current, then the circuit is modeled by

$$\frac{d^2I}{dt^2} + 4\frac{dI}{dt} + 4I = 10\cos t$$

with initial conditions

$$I(0) = 0, \quad I'(0) = 0$$

Obtain a particular solution for $I(t)$.

Question 3 **[7 marks]**

Given the following function

$$\boldsymbol{f(x,y) = 6x^2 - 2x^3 + 3y^2 + 6xy}$$

Determine the position and nature of the stationary points of $f(x,y)$.

Question 4 **[7 marks]**

For the following functions find the first order partial derivatives.

a. $z = e^{(xy^2)} \cos(xy) + e^{(2x+3y)}$ (4 marks)

b. $z = \frac{2x-3e^y}{x^2+y^2}$ (3 marks)

Question 5 **[7 marks]**

A water treatment plant produces three types of treated water: W_1, W_2, and W_3. Each type requires different amounts of three treatment chemicals: chlorine (C_1), alum (C_2), and lime (C_3). The required amounts are given below:

	$C_1\ (kg/m^3)$	$C_2\ (kg/m^3)$	$C_3\ \ (kg/m^3)$
W_1	3	1	2
W_2	1	2	1
W_3	2	4	1

The plant has 50 kg of chlorine, 50 kg of alum, and 34 kg of lime available.

Using Carmer's rule, determine the volume (in m^3) of each treated water type (W_1, W_2, W_3) that should be produced to use all available chemicals.

Question 6 **[6 marks]**

Determine the inverse of the following matrix.

$$A = \begin{pmatrix} 1 & 2 & -1 \\ 3 & 5 & -1 \\ -2 & -1 & -2 \end{pmatrix}$$

This page is for rough work.

Formula sheet:

Inhomogeneous term	Trial solution
Constant	Constant
$ax^r + \cdots + bx + c$	$\alpha x^r + \cdots + \beta x + \delta$
$a\cos kx$	$\alpha\cos kx + \beta\sin kx$
$a\sin kx$	$\alpha\cos kx + \beta\sin kx$
ae^{kx}	αe^{kx}

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**3,4**	Application, Analysis	**5**	
2	**3,4**	Application, Analysis	**8**	
3	**1**	Application	**7**	
4	**2,3**	Application	**7**	
5	**1,2**	Application	**7**	
6	**1**	Application	**6**	

References:

Anthony Croft, R. D., 2015. Mathematics for Engineers. Fourth ed. Harlow: Pearson.

J. Washington, A., 2014. Basic Technical Mathematics with Calculus. 10 ed. Harlow: Pearson Education Limited.

Stewart, J., 2008. *Calculus: Early Transcendentals*. 6th ed. Boston: Brooks/Cole.