EXAMINATION COVERSHEET

Autumn 2022 Final Examination

UNIVERSITY
OF WOLLONGONG
IN DUBAI

THIS EXAMINATION CONTENT IS STRICTLY CONFIDENTIAL

Students must comply with requirements stated in the Examination Policy & Procedures

Student Number:	
First Name:	
Family Name:	
Date of Examination: (DD/MM/YY)	**14/12/2022**
Subject Code:	**MATH 141**
Subject Title:	**Foundation of Engineering Mathematics**
Time Permitted to Write Exam:	2 Hours
Total Number of Questions:	**11 (6 MCQ's + 5 written questions)**
Total Number of Pages *(including this page):*	**9**

INSTRUCTIONS TO STUDENTS FOR THE EXAM

1. Please note that subject lecturer/tutor will be unavailable during exams. *If there is a doubt in any of the exam questions i.e. problem solving etc. students should proceed by assuming values etc. Students should mention their assumption on the question paper.*
2. Answers must be written (and drawn) in black or blue ink
3. Any mistakes must be crossed out. Whitener and ink erasers must not be used.
4. Part A (MCQ): Answer ALL/ 6 questions. The marks for each question are shown next to each question. The total for Part A is 30 marks.
5. Part B (Written): Answer ALL/ 5 questions. The marks for each question are shown next to each question. The total for Part B is 70 marks.
6. Total marks: 100. This Exam is worth 35% of your final marks for MATH 141.

EXAMINATION MATERIALS/AIDS ALLOWED
Approved Calculators. The formula sheet will be provided by the instructor.

Exam Unauthorised Items - Students bringing these items to the examination room must follow the instructions of the invigilators with regards to these items.

7. Bags, including carrier bags, backpacks, shoulder bags and briefcases
8. Any form of electronic device including but not limited to mobile phones, smart watches, MP3 players, handheld computers and unauthorised calculators;
9. Calculator cases and covers, opaque pencil cases
10. Blank paper
11. Any written material

NOTE: The University does not guarantee the safe-keeping of students' personal items during examinations. Students concerned about the safety of their valuable items should make alternative arrangements for their care.

Part 1 MCQ 30% (circle your choice)

(**5pts**)**Problem 1**
Find the values of x and y in the equation

$$x\,(1+i)^2 + y\,(2-i)^2 = 3 + 10i.$$

$x + y$ is equal to

$$(a)\ 10 \qquad (b)\ 8 \qquad (c)\ 7 \qquad (d)\ 11 \qquad (e)\ 13$$

(**5pts**)**Problem 2**
The complex conjugate of $z = x + iy$ is denoted by $\bar{z} = x - iy$. Solve the equation

$$z - 8 = i\,(7 - 2\bar{z})$$

The modulus of the solution z is equal to

$$(a)\ |z| = \sqrt{19} \qquad (b)\ |z| = 13\sqrt{7} \qquad (c)\ |z| = \sqrt{7} \qquad (d)\ |z| = \sqrt{13} \qquad (e)\ |z| = \sqrt{23}$$

(5pts)Problem 3

The point of intersection of the line whose parametric equations are

$$\begin{cases} x = 2 - 2t \\ y = 3t \\ z = 1 + t \end{cases}$$

and the plane $x + 2y - z = 7$ is (a, b, c).
$a + b + c =$

(a) 7 (b) 6 (c) 5 (d) 4 (e) 0

(5pts)Problem 4

If the angle between the vectors $\langle 2,\ 1,\ -1\rangle$ and $\langle 1,\ x,\ 0\rangle$ is $\theta = \dfrac{\pi}{4}$, then $x =$

(a) $1 \pm \sqrt{6}$ (b) $2 \pm \sqrt{6}$ (c) $1 \pm \sqrt{3}$ (d) $1 \pm \frac{\sqrt{3}}{2}$ (e) $1 \pm \frac{\sqrt{6}}{2}$

(5pts)Problem 5
Find the value of x for which the matrix A does not have an inverse.

$$A = \begin{pmatrix} 1 & -1 & -x \\ 0 & 1 & 3 \\ x & 0 & 0 \end{pmatrix}.$$

The sum of all possible values of x is

(a) 4 (b) -6 (c) 3 (d) 0 (e) 5

(5pts)Problem 6
Suppose two vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ satisfy

$$\overrightarrow{a} \cdot \overrightarrow{b} = \sqrt{15} \text{ and } \overrightarrow{a} \times \overrightarrow{b} = \langle -2,\ 0,\ -1 \rangle,$$

then the angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$ (e) $\frac{2\pi}{5}$

Part 2 Written 70%

(15pts)**Problem 1**
Consider the points $A\,(2,\ 0,\ -1)\,,\ \ B\,(1,\ -1,\ 1)\,,\ C\,(0,\ 3,\ -2)$ and $D\,(5,-2,\ -1)\,.$
(a) Find the equation of the plane $(\mathcal{P})$ containing the points $A,\ B,$ and $C.$
(b) Find the distance from D to $(\mathcal{P}).$

(13pts)**Problem 2**
Find the equation of the plane that contains the two lines

$$L_1: \begin{cases} x = 1 + t \\ y = 1 - t \\ z = 2t \end{cases} \quad \text{and} \quad L_2: \begin{cases} x = 2 - t \\ y = t \\ z = 2 \end{cases}.$$

(13pts)**Problem 3**

Use the **Gauss elimination** method to solve the linear system

$$\begin{cases} 3x - y - 5z = 3 \\ 4x - 4y - 3z = -4 \\ x - 5z = 2 \end{cases} . \quad (\text{ Show your work})$$

(15*pts*)**Problem 4**
Consider the following matrices

$$A = \begin{bmatrix} 1 & 0 \\ 2 & -1 \\ 6 & -3 \end{bmatrix}, \qquad B = \begin{bmatrix} -1 & 1 & 2 \\ 4 & 0 & -5 \end{bmatrix}, \text{ and } C = \begin{bmatrix} 2 & 0 \\ -3 & -1 \end{bmatrix}$$

(a) Compute the following matrices, where possible.

$$1.\ A + B^T, \qquad 2.\ AC$$

(b) Find the matrix X such that

$$\frac{3}{2}X + C = \begin{bmatrix} 3 & -4 \\ 5 & 4 \end{bmatrix}.$$

(14*pts*)**Problem 5**

Use the **cofactor expansion method** to find the determinant of the matrix

$$A = \begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & 1 & 2 \end{bmatrix}. \quad \text{(Show your work)}$$

END OF EXAM