

# EXAMINATION COVERSHEET

Spring 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:<br>(DD/MM/YY)   | 27/06/22                              |
|  |                                       |
| Subject Code:  | Math 142                              |
| Subject Title:   | Essentials of Engineering Mathematics |
| Time Permitted to Write Exam:  | 2 Hours                               |
| Total Number of Questions:   | 6 MCQs + 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: MCQs. Answer **ALL** questions. The marks for each question are shown next to each question.
5. Part B: Written. Answer **ALL** questions. The marks for each question are shown next to each question.
6. You must show your work in detail.
7. Total marks: 100. This Exam is worth **40%** of your final marks for **Math 142**.

## EXAMINATION MATERIALS/AIDS ALLOWED

### **Approved Calculators and Formula Sheet**

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

8. Bags, including carrier bags, backpacks, shoulder bags and briefcases
9. Any form of electronic device including but not limited to mobile phones, smart watches, MP3 players, handheld computers and unauthorised calculators;
10. Calculator cases and covers, opaque pencil cases
11. Blank paper
12. 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 A MCQ (30%) (circle your choice)

### (5pts) Problem 1

Evaluate the improper integral  $L = \int_2^{\infty} \frac{dx}{x \ln^2 x}$ .

(a)  $L = \ln 2$

(b)  $L = \frac{1}{\ln 2}$

(c)  $L = +\infty$

(d)  $L = 2$

(e)  $L = e^2$

### (5pts) Problem 2

Evaluate the improper integral  $A = \int_0^1 \frac{x}{\sqrt{1-x^2}} dx$

(a)  $A = 1$

(b)  $A = 2$

(c)  $A = -1$

(d)  $A = \frac{1}{2}$

(e)  $A = -\infty$

(5pts) **Problem 3**

Let  $a_n$  be the sequence given by

$$\cos(\pi), \cos\left(\frac{\pi}{2}\right), \cos\left(\frac{\pi}{3}\right), \cos\left(\frac{\pi}{4}\right), \dots$$

If  $L = \lim_{n \rightarrow \infty} a_n$ , then

(a)  $L = 4$

(b)  $L = 3$

(c)  $L = 2$

(d)  $L = 1$

(e)  $L = 0$

(5pts) **Problem 4**

The series

$$\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt[3]{n}}$$

(a) converges absolutely

(b) converges conditionally

(c) diverges

(d) is a convergent geometric series

(e) is a divergent telescoping series

(5pts) **Problem 5**

The radius of convergence of the power series  $\sum_{n=1}^{\infty} \frac{x^n}{n2^n}$  is

(a)  $\sqrt{2}$

(b)  $\frac{1}{2}$

(c)  $1$

(d)  $\infty$

(e)  $2$

(5pts) **Problem 6**

The coefficient of  $x^3$  in Maclaurin series of the function  $f(x) = \sin(\pi - x)$  equal to

(a)  $-\frac{1}{3}$

(b)  $-\frac{1}{6}$

(c)  $-1$

(d)  $-6$

(e)  $\frac{-1}{2}$

## Part B Written Questions (70%)

### (15pts) Problem 1

Find the interval of convergence of the following power series

$$1. \sum_{n=0}^{\infty} \frac{(x+2)^n}{\sqrt{n}} \qquad 2. \sum_{n=0}^{\infty} \frac{x^n}{n^n}.$$

(10pts)**Problem 2**

Show that the equation is separable and solve it.

$$y \frac{dy}{dx} - (1 + y^2) x^2 = 0$$

(15pts)**Problem 3**

Show that the differential equation is exact and solve the initial value problem.

$$(y - x^3) dx + (x + y^3) dy = 0, \quad y(0) = \sqrt{2}$$

(15pts)**Problem 4**

Show that the equation is Bernoulli and solve it.

$$\frac{dy}{dx} = \frac{2y}{x} - x^2 y^2$$



(15pts)**Problem 5**

Show that the equation is homogeneous and solve it.

$$x^2 \frac{dy}{dx} = xy - y^2$$