

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

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**EXAMINATION PERIOD
DECEMBER 2021**

**MODULE CODE: ACMA4006 (PART-TIME)
ENGINEERING MATHEMATICS (TEST 2)**

TIME: 1 ½ HOURS

ANSWER ALL QUESTIONS

Equipment or materials required –

Calculators allowed

Formula booklet provided

Show all workings

IMPORTANT INSTRUCTIONS FOR ONLINE EXAMINATIONS:

- ***You will need to submit a digital photograph or scan of each page of workings***
- ***Please submit these to Moodle (underneath where you accessed the exam paper)***
- ***Put the time, date, module code and your student number at the top of each page***
- ***Number each page ‘x of y’***
- ***If you have any issues, email richard.sutton@uwtsd.ac.uk***

QUESTION ONE – MATRICES

a) Consider the following matrices:

$$A = \begin{pmatrix} 5 & 1 & 2 \\ 2 & 6 & 3 \\ -2 & 1 & 0 \end{pmatrix} \quad B = \begin{pmatrix} 3 & 5 & 1 \\ -2 & 0 & 3 \\ 0 & 4 & 2 \end{pmatrix} \quad C = \begin{pmatrix} 1 & 2 \\ -1 & 4 \\ 1 & 8 \end{pmatrix} \quad D = \begin{pmatrix} 9 & 10 \\ 2 & 15 \end{pmatrix}$$

Calculate the following, if mathematically possible:

(i) AB

(ii) AC

(iii) A+B

(iv) A+D

(v) BD

(vi) 2D

(15 mark)

b) Use Cramer's rule to solve the following simultaneous equations:

$$3x + 2y + z = 15$$

$$x - y + 4z = -2$$

$$2x + 5y + 2z = 16$$

(8 marks)

c) If a matrix is denoted by **A**, what is denoted by $|\mathbf{A}|$?

(1 mark)

Turn over for questions 2 and 3.

QUESTION TWO – COMPLEX NUMBERS

a) Given the following complex numbers, $z_1 = 2 + 5j$, $z_2 = 1 - 8j$ and $z_3 = -3 + 2j$, calculate the following, expressing your answers in cartesian form:

(i) $z_1 + z_2$ (ii) $z_1 - z_3$ (iii) $\frac{z_1}{z_2}$

(6 marks)

b) Solve the following quadratic equation, **expressing your answers in Polar Form**:

$$12x^2 + 2x = -19$$

(10 marks)

c) Use de Moivre's theorem to calculate the following, giving your answers in rectangular form:

(i) $(-4 - 7j)^6$

(6 marks)

QUESTION THREE – INTEGRATION

a) Integrate the following:

(i) $\int 5x^3 - 2x^2 + 4x - 1 \, dx$

(ii) $\int (x + 2)(x + 5)(x - 1) \, dx$

(iii) $\int 3 \cos 2x - \frac{1}{x} \, dx$

(iv) $\int_3^6 (5x + 2)(2x + 3) \, dx$

(v) $\int_0^3 (3x + 1)^2 + 2e^{3x} \, dx$

(28 marks)

b) Use integration by parts to integrate the following:

(i) $\int 3x \sin 4x \, dx$

(ii) $\int 2x e^{3x} \, dx$

(12 marks)

TOTAL MARKS: 86

End of paper.