CURTIN UNIVERSITY
Department of Mathematics and Statistics

Linear Algebra and Statistics for Engineers

MID-SEMESTER TEST

Semester 2, 2017

INSTRUCTIONS: Answer all questions in the spaces provided.

To obtain full marks for a question you must **clearly** show appropriate working.

TIME ALLOWED: 55 minutes.

TOTAL MARKS: 40

AIDS ALLOWED:
1. Scientific Calculator.
2. A4 Sheet of handwritten or typed notes (both sides).

Last Name: _____

Given Name: _____

Student Number: _____

Tutors Name: _____

Workshop Day: _____ Workshop Time: _____

Question 1

Solve following systems of linear equations by first writing it in the form of an augmented matrix $[A|\boldsymbol{b}]$ and then using the Gaussian Elimination method. Make sure you state the rank of A and the rank of $[A|\boldsymbol{b}]$.

$$\begin{aligned} x_1 + x_2 - x_3 &= 0 \\ 2x_1 - x_2 - x_3 &= -2 \\ 4x_1 + x_2 - 3x_3 &= 5 \end{aligned}$$

(6 marks)

Question 2 is on the next page…

Question 2

Solve the following homogeneous system of linear equations by first writing it in the form of an augmented matrix $[A|\mathbf{0}]$ and then using the Gaussian Elimination method. Make sure you state the rank of A.

$$\begin{aligned} 2x_1 - x_2 + 2x_3 &= 0 \\ -x_1 + x_2 + x_3 &= 0 \\ -x_1 - 3x_3 &= 0 \end{aligned}$$

(8 marks)

Question 3 is on the next page…

Question 3

Find the inverse of the matrix,

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 6 \end{bmatrix}$$

(6 marks)

Question 4 is on the next page…

Question 4

Solve the following system of linear equations by using the inverse of the coefficient matrix,

$$7x_1 + 3x_2 = -8$$
$$8x_1 + 4x_2 = -8$$

(6 marks)

Question 5

Calculate the determinant $|B|$ of the matrix $B = \begin{bmatrix} 1 & 0 & 3 \\ 5 & 6 & 2 \\ 3 & -2 & 1 \end{bmatrix}$. From this determinant value, does B have an inverse? Give a reason for your decision. (Note: you do not have to calculate the inverse matrix if it exists) (8 marks)

Question 6

Use Cramer's rule to solve the following system for x_1,

$$2x_1 + 4x_2 = -2$$
$$-3x_1 + x_2 = -11$$

(6 marks)