ATHLONE INSTITUTE OF TECHNOLOGY

SCHOOL OF ENGINEERING

SAMPLE (IN-HOUSE) EXAMINATIONS 2011

Christmas Session

BSc (Hons) SOFTWARE DESIGN (GAME AND WEB DEVELOPMENT)

YEAR 1

MATHEMATICS

Internal Examiner(s): **Dr. Mark Daly**

Instructions to candidates:
Read all questions carefully.
All questions carry equal marks.
Answer **ANY 3** out of **4** questions.

Time Allowed: 1 ¾ Hours

No. of pages including cover sheet: 3

Q.1. For each of the following functions

(i) Graph the function in the interval specified.

(ii) Estimate the value(s) of x where the graph crosses the horizontal axis.

(iii) Estimate the turning point(s) of the function in the interval.

(a) $f(x)=x^2-x-6$ on the interval $[-4,6]$. (10 Marks)

(b) $f(x)=x^3-8x^2+2x+10$ on the interval $[-3,9]$. (10 Marks)

[20 Marks]

Q.2. (a) Determine all values of x for which the matrices below are non-singular:

(i) $\begin{pmatrix} 1 & 0 & 0 \\ 2 & 3x & -4 \\ 5 & 0 & x \end{pmatrix}$ (ii) $\begin{pmatrix} 2 & 1 & 6 \\ 3 & -x & 4 \\ -6 & 0 & 1-x \end{pmatrix}$

(6 Marks)

(b) Calculate the inverse of the following matrix:

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

(12 Marks)

(c) Solve the system of linear equations:

$$\begin{aligned} x+y-2z&=0 \\ 2x-y+3z&=5 \\ -x+y-3z&=-4 \end{aligned}$$

(2 Marks)

[20 Marks]

Q.3. (a) Calculate the first six terms in the Taylor series of the following functions about the points specified:

(i) $f(x) = \sin(x)$ about $x_o = \pi/2$. (5 Marks)

(ii) $f(x) = e^x$ about $x_o = 0$. (5 Marks)

(b) Estimate the error in $T_5(x)$ for e^2 about $x_0 = 0$.

(10 Marks)

[20 Marks]

Q.4. Differentiate each of the following functions of x with respect to x:

(a) $f(x)=\left(\cos^2(x)+\sin^2(x)\right)e^{2x}$ (5 Marks)

(b) $f(x)=e^{\ln|e^x|}$ (5 Marks)

(c) $f(x)=e^{(\cos(2x))}$ (5 Marks)

(d) $f(x)=\dfrac{x^8-1}{x^7+x^6+x^5+x^4+x^3+x^2+x+1}$ (5 Marks)

[20 Marks]