UNIVERSITY *of* LIMERICK
OLLSCOIL LUIMNIGH

Faculty of Science and Engineering
Department of Mathematics & Statistics

MID TERM ASSESSMENT PAPER

MODULE CODE: MA4003

SEMESTER: Autumn 2008/09

MODULE TITLE: Engineering Mathematics 3

DURATION OF EXAMINATION: 45 minutes

LECTURER: Dr. M. Burke

PERCENTAGE OF TOTAL MARKS: 20 %

INSTRUCTIONS TO CANDIDATES: **Answer all questions. All questions carry equal marks. Use the Answer Sheet below.**

ANSWER SHEET

STUDENT'S NAME:
STUDENT'S ID NUMBER:

For each question, place an "**X**" in the box of your choice.

Question	a	b	c	d	e	Do not write in this column
1			**x**			
2	**x**					
3				**x**		
4		**x**				
5					**x**	
6				**x**		
7			**x**			
8		**x**				
9					**x**	
10		**x**				

Table of Laplace Transforms

$f(t),\ t \geq 0$	$F(s) = \mathcal{L}[f(t)]$
1	$\frac{1}{s}$
t	$\frac{1}{s^2}$
t^n	$\frac{n!}{s^{n+1}}$
e^{at}	$\frac{1}{s-a}$
$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$
$\sinh at$	$\frac{a}{s^2-a^2}$
$\cosh at$	$\frac{s}{s^2-a^2}$
$\frac{1}{a-b}(e^{at} - e^{bt})$	$\frac{1}{(s-a)(s-b)}$
$\frac{a}{a-b}e^{at} - \frac{b}{a-b}e^{bt}$	$\frac{s}{(s-a)(s-b)}$
$\sin at$	$\frac{a}{s^2+a^2}$
$\cos at$	$\frac{s}{s^2+a^2}$
$f'(t)$	$sF(s) - f(0)$
$f''(t)$	$s^2F(s) - sf(0) - f'(0)$
$\int_0^t f(\tau)\, d\tau$	$\frac{1}{s}F(s)$
$e^{at}f(t)$	$F(s-a)$
Heaviside $u_a(t)$	$\frac{e^{-as}}{s}$
$f(t-a)u_a(t)$	$e^{-as}F(s)$
Ramp $R(t-a)$	$\frac{e^{-as}}{s^2}$
$tf(t)$	$-F'(s)$
$\dfrac{f(t)}{t}$	$\displaystyle\int_s^\infty F(\sigma)\, d\sigma$
$(f * g)(t) \equiv \displaystyle\int_0^t f(t-\tau)g(\tau)\, d\tau$	$F(s)G(s)$
$f(t) = f(t+p)$	$\dfrac{1}{1-e^{-sp}} \displaystyle\int_0^p f(t)e^{-st}\, dt$

All $f(t)$ are defined for $t \geq 0$.

1. The *Laplace* Transform of e^{-2t+2} is

   $(a)\ \dfrac{2e^{-s}}{s-1}\quad (b)\ \dfrac{e^{-s}}{s+2}\quad (c)\ \dfrac{e^{2}}{s+2}\quad (d)\ \dfrac{e^{-2s}}{s-1}\quad (e)\ \dfrac{e^{-2}}{s+1}$

2. The *Laplace* Transform of $e^{-2t}\cosh t$ is

   $(a)\ \dfrac{s+2}{(s+2)^2-1}\quad (b)\ \dfrac{s+2}{(s+2)^2-4}\quad (c)\ \dfrac{s-1}{(s-1)^2+4}\quad (d)\ \dfrac{s+2}{(s+2)^2+1}\quad (e)\ \dfrac{e^{-2s}}{s^2-1}$

3. The *Laplace* Transform of $f(t) = \sin(3t-3)u_1(t)$ is

   $(a)\ \dfrac{1}{s^2+9}e^{-s}\quad (b)\ \dfrac{3}{s(s^2+9)}\quad (c)\ \dfrac{3}{s^2+9}e^{-3s}\quad (d)\ \dfrac{3}{s^2+9}e^{-s}\quad (e)\ \dfrac{1}{s^2+1}e^{-3s}$

4. The inverse *Laplace* transform of $\frac{s}{s^2+2s+1}$ is

   $(a)\ e^{-t}\quad (b)\ (1-t)e^{-t}\quad (c)\ te^{-t}\quad (d)\ e^{-t}\sin t\quad (e)\ e^{-2t}$

5. The inverse *Laplace* transform of $\frac{s-2}{s^2-5s+6}$ is

   $(a)\ e^{-3t}\quad (b)\ -e^{-2t}+2e^{-3t}\quad (c)\ 2e^{2t}-e^{3t}\quad (d)\ -e^{2t}+2e^{3t}\quad (e)\ e^{3t}$

6. The convolution of e^t with e^t (also denoted by $e^t * e^t$) is given by

   $(a)\ t\quad (b)\ 1-e^{t}\quad (c)\ e^{t}-1\quad (d)\ te^{t}\quad (e)\ \dfrac{e^{2t}-1}{2}$

7. The period of $\cos\left(\frac{2\pi x}{5}\right)$ is

   $(a)\ \dfrac{1}{5}\quad (b)\ \dfrac{5}{2}\quad (c)\ 5\quad (d)\ \dfrac{5}{2}\pi\quad (e)\ 2\pi$

8. The functions $f(x) = x + x^3$ and $g(x) = x\cos x$ defined on $-1 < x < 1$ have the property that
   (a) both are even (b) both are odd (c) f is odd and g is even
   (d) f is even and g is odd (e) neither is even nor odd

9. The function $f(x) = x$ for $-\pi < x < \pi$ is periodic with period 2π. It has a *Fourier* Series $\sum_{n=1}^{\infty} b_n \sin(**)$ where ** is given by

   $(a)\ \dfrac{n\pi x}{2}\quad (b)\ n\pi x\quad (c)\ 2n\pi x\quad (d)\ \dfrac{nx}{2}\quad (e)\ nx$

10. The coefficient a_0 in the *Fourier* Series for the periodic function $f(x) = x^3$ if $-1 < x < 1$ with period 2 has the value

    $(a)\ -1\quad (b)\ 0\quad (c)\ \dfrac{1}{4}\quad (d)\ \dfrac{1}{2}\quad (e)\ 1$