Differential Eqns MAP2302 **U-Class** Prof. JLF King Wed., 15Nov2017

Welcome. **Use "$f(x)$ notation" when writing fncs; in particular, for trig and log fncs. E.g, write "$\sin(x)$" rather than the horrible $\sin x$ or $[\sin x]$.**

U1: Show no work.

a) A *minimum* requirement for an LOR (letter-of-recommendation) from Prof. K is two courses. Circle:

Yes **True** **Darn tootin'!**

b) With $f(x) := e^{7x}$ and $g(x) := e^{5x}$, then

$[f \circledast g](t) =$ ________

c) This Wronskian

is $\mathcal{W}(e^{3t}, \cos(2t)) =$ ________

d) Suppose $y(0) = 2$, $y'(0) = 3$, $y''(0) = 5$. Then $\mathcal{L}(y^{(3)} + 2y')(s)$ equals $[[p(s) \cdot \widehat{y}(s)] + q(s)]$ for **polynomials**

$p(s) =$ ________

and $q(s) =$ ________.

e) Let $h()$ be this square-wave: $h(t) := 5$ if (floor) $\lfloor t \rfloor$ is a multiple of 3, and

$h(t) := 0$ otherwise. Then $\widehat{h}(s) =$ ________.

f) $\mathcal{L}(t^{26} e^{3t})(s) =$ ________.

Determine the inverse-transform, please.

$\mathcal{L}^{-1}\left(\dfrac{3s+5}{s^2+2s+5}\right)(t) =$ ________

g) Op $\mathsf{L}(y) := 3t^2y'' + 7ty' - 4y$ is equidim'nal. The

gen.soln to $\mathsf{L}(y)=0$ is $y(t) = \alpha\cdot$ ____ $+ \beta\cdot$ ____.

U2: Show no work.

A *critically-damped* unforced spring has DE

$$*: \quad \mathbf{M}y'' + \mathbf{B}y' + \mathbf{K}y = 0\,\frac{\mathsf{kg\cdot m}}{\mathsf{sec}^2}, \quad \textit{where}$$
$$\mathbf{M} := 3\mathsf{kg}, \quad \textit{and the Hooke's constant is } \mathbf{K} := 75\frac{\mathsf{kg}}{\mathsf{sec}^2}.$$

The damping constant $\mathbf{B} =$ ________.

The *general soln* to critically-damped $(*)$ is

$y(t) = \left[\alpha\cdot \text{\_\_\_\_\_\_\_\_} + \beta\cdot \text{\_\_\_\_\_\_\_\_}\right]\mathsf{m}.$

Here, $\alpha, \beta \in \mathbb{C}$. (*The 3 blanks will have units & numbers in various places.* Maybe exp(?) is more convenient than $e^?$ notation.) The **specific** soln with $y(0\mathsf{sec}) = 0\mathsf{m}$ and $y'(0\mathsf{sec}) = 2\,\frac{\mathsf{m}}{\mathsf{sec}}$ has $\alpha =$ ____, $\beta =$ ____.

End of U-Class

U1:	___ ___ ___	170pts
U2:	___ ___	55pts
Total:	___ ___ ___	225pts