For each question,"**X**" indicates a correct choice.

ANSWER SHEET - YELLOW

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**				

ANSWER SHEET - BLUE

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**	

ANSWER SHEET - GREEN

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**		

QUESTION SHEET - YELLOW

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

1. The *Laplace* Transform of $t \sin t$ is

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

2. The functions $f(x) = x\cos x$ and $g(x) = 3x+1$ defined on $-2 < x < 2$ 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) at least one is neither even nor odd

3. The inverse *Laplace* transform of $\frac{2}{s^3}e^{-2s}$ is

(a) $(t-2)^2$ (b) $(t-2)^2 u_2(t)$ (c) $t^2 u_2(t)$ (d) $t^2 e^{-3t}$ (e) $t^2 u_0(t)$

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

(a) 0 (b) $\dfrac{\sinh 1}{2}$ (c) $\dfrac{\cosh 1}{2}$ (d) $\sinh 1$ (e) $\cosh 1$

5. The function $f : \mathbb{R} \to \mathbb{R}$ has period 2π. The period of $f(3x)$ is

(a) $\dfrac{\pi}{2}$ (b) $\dfrac{2\pi}{3}$ (c) 2π (d) 3π (e) 6π

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

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

7. The *Laplace* Transform of $f(t) = \cosh(t-3)u_3(t)$ is

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

8. The *Laplace* Transform of $e^t\left(\frac{1}{2}t^2 + 2t + 1\right)$ is

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

9. The function $f(x) = \begin{cases} 0, & \text{if } -\pi < x < 0 \\ 2, & \text{if } 0 < x < \pi \end{cases}$ is periodic with period 2π. It has a *Fourier* Series $1 + \sum_{n=1}^{\infty} b_n \sin(nx)$; b_3 is given by

(a) $-\dfrac{2}{3\pi}$ (b) 0 (c) $\dfrac{2}{\pi}$ (d) $\dfrac{2}{3\pi}$ (e) $\dfrac{4}{3\pi}$

10. The partial fraction expansion (PFE) of $\frac{2s+1}{s^2(s+2)}$ is

(a) $\dfrac{1}{s^2}+\dfrac{2}{s}+\dfrac{1}{s+2}$ (b) $\dfrac{1}{2s^2}+\dfrac{3}{4s}-\dfrac{3}{4(s+2)}$

(c) $\dfrac{1}{2s^2}-\dfrac{3}{4(s+2)}$ (d) $\dfrac{3}{2s}+\dfrac{1}{s+2}$ (e) $\dfrac{1}{2s}+\dfrac{3}{2(s+2)}$

QUESTION SHEET - BLUE

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

1. The *Laplace* Transform of $e^t\left(\frac{1}{2}t^2 + 2t + 1\right)$ is

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

2. The inverse *Laplace* transform of $\frac{2}{s^3}e^{-2s}$ is

   $(a)\ (t-2)^2$ $(b)\ (t-2)^2u_2(t)$ $(c)\ t^2u_2(t)$ $(d)\ t^2e^{-3t}$ $(e)\ t^2u_0(t)$

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   $(a)\ \dfrac{1}{s^2} + \dfrac{2}{s} + \dfrac{1}{s+2}$ $(b)\ \dfrac{1}{2s^2} + \dfrac{3}{4s} - \dfrac{3}{4(s+2)}$

   $(c)\ \dfrac{1}{2s^2} - \dfrac{3}{4(s+2)}$ $(d)\ \dfrac{3}{2s} + \dfrac{1}{s+2}$ $(e)\ \dfrac{1}{2s} + \dfrac{3}{2(s+2)}$

4. The function $f : \mathbb{R} \to \mathbb{R}$ has period 2π. The period of $f(3x)$ is

   $(a)\ \dfrac{\pi}{2}$ $(b)\ \dfrac{2\pi}{3}$ $(c)\ 2\pi$ $(d)\ 3\pi$ $(e)\ 6\pi$

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$$(c)\ \frac{1}{2s^2}-\frac{3}{4(s+2)} \qquad (d)\ \frac{3}{2s}+\frac{1}{s+2} \qquad (e)\ \frac{1}{2s}+\frac{3}{2(s+2)}$$

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