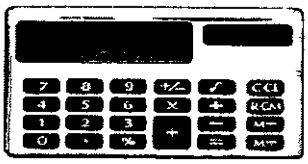
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

MAT3700

May/June 2013

MATHEMATICS III (ENGINEERING)

Duration 2 Hours

84 Marks

EXAMINATION PANEL AS APPOINTED BY THE DEPARTMENT

Use of a non-programmable pocket calculator is permissible

Closed book examination.

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This examination question paper consists of 3 pages including this cover page plus

Formulae sheets (page (i) to (v), plus
A table of integrals (page (i) and (ii)) plus
A table of Laplace transforms (page iii)

Answer all the questions **in numerical order.**

QUESTION 1

Solve the following differential equations

1 1 $x(y-3)dy = 4ydx$ (4)

1 2 $(x^3+y^3)dx - 3xy^2dy = 0$ [Hint Put $y = vx$] (7)

1 3 $\frac{dy}{dx} + y\cot x = 5e^{\cos x}$ (5)

[16]

QUESTION 2

Find the general solutions of the following differential equations using **D-operator** methods

2 1 $(D^2+9)y = \cos(2x+3)$ (5)

2 2 $D(D^2+3D+2)y = x^2+4x+8$ (9)

[14]

QUESTION 3

The equation of motion of a body is given by $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 13y = e^{2t}\cos t$, where y is the distance and t is the time

Determine a general solution for y in terms of t, by using **D-operator methods.** (9)

[9]

QUESTION 4

Solve for $\boldsymbol{x}$ in the following set of simultaneous differential equations by using **D-operator** methods

$$(D+2)x + 3y = 0$$
$$3x + (D+2)y = 2e^{2t}$$
(7)

[7]

QUESTION 5

Determine the following

5 1 $L\{t^2H(t-1)\}$ (3)

5 2 $L^{-1}\left\{\frac{4s+5}{s^2+9}\right\}$ (2)

[5]

[TURN OVER]

QUESTION 6

Determine the unique solution of the following differential equation by using **Laplace transforms:** $y''(t)+2y'(t)-3y(t)=e^{-3t}$, if $y(0)=0$ and $y'(0)=0$

$$\left[\text{Given } \frac{1}{(s+3)^2(s-1)}=\frac{-1}{16(s+3)}-\frac{1}{4(s+3)^2}+\frac{1}{16(s-1)}\right]$$ (7)

[7]

QUESTION 7

A cantilever beam, clamped at $x = 0$ and free at $x = b$, carries a uniform load k per unit length Given the differential equation $\frac{d^4y}{dx^4}=\frac{k}{EI}, 0<x<b$ and boundary conditions $y(0)=0, y'(0)=0, y''(b)=0$ and $y'''(b)=0$, show that the deflection of the beam is given by $y(x)=\frac{k}{24EI}\left(x^4-4bx^3+6b^2x^2\right)$ by using **Laplace transforms.** (10)

[10]

QUESTION 8

If $A=\begin{bmatrix}3 & -1\\ 1 & 1\end{bmatrix}$, determine the eigenvalues of A and an eigenvector for A (6)

[6]

QUESTION 9

Given the function defined by $f(t)=\begin{cases}-\pi & -\pi<t<0\\ t & 0<t<\pi\end{cases}$, with a period of 2π.

9 1 Determine a_0 and a_n to write down the Fourier series for $f(t)$ (8)

9 2 Write down the Fourier series for $f(t)$ given that $b_n=\frac{1-2(-1)^n}{n}$ (2)

[10]

Full marks = 84

Examiners First Ms L E Greyling
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FORMULA SHEET

ALGEBRA

Laws of indices

1 $a^m \times a^n = a^{m+n}$

2 $\dfrac{a^m}{a^n} = a^{m-n}$

3 $(a^m)^n = a^{mn} = (a^n)^m$

4 $a^{\frac{m}{n}} = \sqrt[n]{a^m}$

5 $a^{-n} = \dfrac{1}{a^n}$ and $a^n = \dfrac{1}{a^{-n}}$

6 $a^0 = 1$

7 $\sqrt{ab} = \sqrt{a}\sqrt{b}$

8 $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

Logarithms

Definitions If $y = a^x$ then $x = \log_a y$

If $y = e^x$ then $x = \ell n\, y$

1 $\log(A \times B) = \log A + \log B$

2 $\log\left(\dfrac{A}{B}\right) = \log A - \log B$

3 $\log A^n = n \log A$

4 $\log_a A = \dfrac{\log_b A}{\log_b a}$

5 $a^{\log_a f} = f \quad \therefore \quad e^{\ell n f} = f$

Factors

$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

Partial fractions

$$\frac{f(x)}{(x+a)(x+b)(x+c)} = \frac{A}{(x+a)} + \frac{B}{(x+b)} + \frac{C}{(x+c)}$$

$$\frac{f(x)}{(x+a)^3(x+b)} = \frac{A}{(x+a)} + \frac{B}{(x+a)^2} + \frac{C}{(x+a)^3} + \frac{D}{(x+b)}$$

$$\frac{f(x)}{(ax^2+bx+c)(x+d)} = \frac{Ax+B}{(ax^2+bx+c)} + \frac{C}{(x+d)}$$

Quadratic formula

If $ax^2 + bx + c = 0$

then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Determinants

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = a_{11}\begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} - a_{12}\begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix} + a_{13}\begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}$$

$$= a_{11}(a_{22}a_{33} - a_{32}a_{23}) - a_{12}(a_{21}a_{33} - a_{31}a_{23}) + a_{13}(a_{21}a_{32} - a_{31}a_{22})$$

SERIES

Binomial Theorem

$$(a+b)^n = a^n + na^{n-1}b + \frac{n(n-1)}{2!}a^{n-2}b^2 + \frac{n(n-1)(n-2)}{3!}a^{n-3}b^3 + \ldots$$

and $|b| < |a|$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \ldots$$

and $-1 < x < 1$

Maclaurin's Theorem

$$f(x) = f(0) + \frac{f'(0)}{1!}x + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3 + \ldots + \frac{f^{n-1}(0)}{(n-1)!}x^{n-1} + \ldots$$

Taylor's Theorem

$$f(x) = f(a) + \frac{f'(a)}{1!}(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3 + \ldots + \frac{f^{n-1}(a)}{(n-1)!}(x-a)^{n-1} + \ldots$$

$$f(a+h) = f(a) + \frac{h}{1!}f'(a) + \frac{h^2}{2!}f''(a) + \ldots + \frac{h^{n-1}}{(n-1)!}f^{n-1}(a) + \ldots$$

COMPLEX NUMBERS

1. $z = a + bj = r(\cos\theta + j\sin\theta) = r\underline{|\theta} = re^{j\theta}$, where $j^2 = -1$

   Modulus $r = |z| = \sqrt{(a^2 + b^2)}$

   Argument $\theta = \arg z = \arctan\frac{b}{a}$

2. Addition

   $(a + jb) + (c + jd) = (a + c) + j(b + d)$

3. Subtraction

   $(a + jb) - (c + jd) = (a - c) + j(b - d)$

4. If $m + jn = p + jq$, then $m = p$ and $n = q$

5. Multiplication $z_1 z_2 = r_1 r_2 \underline{|(\theta_1 + \theta_2)}$

6. Division $\frac{z_1}{z_2} = \frac{r_1}{r_2}\underline{|(\theta_1 - \theta_2)}$

7. De Moivre's Theorem

   $[r\underline{|\theta}]^n = r^n \underline{|n\theta} = r^n(\cos n\theta + j\sin n\theta)$

8. $z^{\frac{1}{n}}$ has n distinct roots

   $z^{\frac{1}{n}} = r^{\frac{1}{n}}\underline{\left|\frac{\theta + k360^\circ}{n}\right.}$ with $k = 0, 1, 2, \ldots, n-1$

9. $re^{j\theta} = r(\cos\theta + j\sin\theta)$

   $\therefore \Re(re^{j\theta}) = r\cos\theta$ and $\Im(re^{j\theta}) = r\sin\theta$

10. $e^{a+jb} = e^a(\cos b + j\sin b)$

11. $\ell n\, re^{j\theta} = \ell n\, r + j\theta$

GEOMETRY

1 Straight line
$$y = mx + c$$
$$y - y_1 = m(x - x_1)$$

Perpendiculars, then $m_1 = \dfrac{-1}{m_2}$

2 Angle between two lines

$$\tan\theta = \frac{m_1 - m_2}{1 + m_1 m_2}$$

3 Circle

$$x^2 + y^2 = r^2$$
$$(x-h)^2 + (y-k)^2 = r^2$$

4 Parabola

$$y = ax^2 + bx + c$$

axis at $x = \dfrac{-b}{2a}$

5 Ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

6 Hyperbola

$$xy = k$$
$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \quad (\text{round } x\text{-axis})$$
$$-\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad (\text{round } y\text{-axis})$$

MENSURATION

1 Circle (θ in radians)

$$\text{Area} = \pi r^2$$
$$\text{Circumference} = 2\pi r$$
$$\text{Arc length } s = r\theta$$
$$\text{Sector area} = \frac{1}{2}r^2\theta = \frac{1}{2}sr$$
$$\text{Segment area} = \frac{1}{2}r^2(\theta - \sin\theta)$$

2 Ellipse

$$\text{Area} = \pi ab$$
$$\text{Circumference} = \pi(a+b)$$

3. Cylinder.

$$\text{Volume} = \pi r^2 h$$
$$\text{Surface area} = 2\pi rh + 2\pi r^2$$

4 Pyramid

$$\text{Volume} = \frac{1}{3}\text{area base} \times \text{height}$$

5 Cone

$$\text{Volume} = \frac{1}{3}\pi r^2 h$$
$$\text{Curved surface} = \pi r\ell$$

6 Sphere

$$A = 4\pi r^2$$
$$V = \frac{4}{3}\pi r^3$$

7 Trapezoidal rule

$$A = h\left(\frac{y_1 + y_n}{2} + y_2 + y_3 + \quad + y_{n-1}\right)$$

8 Simpsons rule

$$A = \frac{s}{3}\left((F + L) + 4E + 2R\right)$$

9 Prismoidal rule

$$V = \frac{h}{6}(A_1 + 4A_2 + A_3)$$

HYPERBOLIC FUNCTIONS

Definitions

$$\sinh x = \frac{e^x - e^{-x}}{2}$$

$$\cosh x = \frac{e^x + e^{-x}}{2}$$

$$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

Identities

$$\cosh^2 x - \sinh^2 x = 1$$

$$1 - \tanh^2 x = \operatorname{sech}^2 x$$

$$\coth^2 x - 1 = \operatorname{cosech}^2 x$$

$$\sinh^2 x = \frac{1}{2}(\cosh 2x - 1)$$

$$\cosh^2 x = \frac{1}{2}(\cosh 2x + 1)$$

$$\sinh 2x = 2\sinh x \cosh x$$

$$\cosh 2x = \cosh^2 x + \sinh^2 x$$

$$= 2\cosh^2 x - 1$$

$$= 1 + 2\sinh^2 x$$

TRIGONOMETRY

Identities

$$\sin^2\theta + \cos^2\theta = 1$$

$$1 + \tan^2\theta = \sec^2\theta$$

$$\cot^2\theta + 1 = \operatorname{cosec}^2\theta$$

$$\sin(-\theta) = -\sin\theta$$

$$\cos(-\theta) = +\cos\theta$$

$$\tan(-\theta) = -\tan\theta$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

Compound angle addition and subtraction formulae

$\sin(A + B) = \sin A \cos B + \cos A \sin B$

$\sin(A - B) = \sin A \cos B - \cos A \sin B$

$\cos(A + B) = \cos A \cos B - \sin A \sin B$

$\cos(A - B) = \cos A \cos B + \sin A \sin B$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Double angles

$\sin 2A = 2 \sin A \cos A$

$\cos 2A = \cos^2 A - \sin^2 A$

$= 2\cos^2 A - 1$

$= 1 - 2\sin^2 A$

$\sin^2 A = ½(1 - \cos 2A)$

$\cos^2 A = ½(1 + \cos 2A)$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Products of sines and cosines into sums or differences

$\sin A \cos B = ½(\sin(A + B) + \sin(A - B))$

$\cos A \sin B = ½(\sin(A + B) - \sin(A - B))$

$\cos A \cos B = ½(\cos(A + B) + \cos(A - B))$

$\sin A \sin B = -½(\cos(A + B) - \cos(A - B))$

Sums or differences of sines and cosines into products

$$\sin x + \sin y = 2\sin\left[\frac{x+y}{2}\right]\cos\left[\frac{x-y}{2}\right]$$

$$\sin x - \sin y = 2\cos\left[\frac{x+y}{2}\right]\sin\left[\frac{x-y}{2}\right]$$

$$\cos x + \cos y = 2\cos\left[\frac{x+y}{2}\right]\cos\left[\frac{x-y}{2}\right]$$

$$\cos x - \cos y = -2\sin\left[\frac{x+y}{2}\right]\sin\left[\frac{x-y}{2}\right]$$

DIFFERENTIATION

1 $\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

2 $\frac{d}{dx} k = 0$

3 $\frac{d}{dx} ax^n = anx^{n-1}$

4 $\frac{d}{dx} f\,g = f\,g' + g\,f'$

5 $\frac{d}{dx} \frac{f}{g} = \frac{g\,f' - f\,g'}{g^2}$

6 $\frac{d}{dx} [f(x)]^n = n[f(x)]^{n-1} f'(x)$

7 $\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dv} \frac{dv}{dx}$

8 Parametric equations

$$\frac{dy}{dx} = \frac{dy}{d\theta} \Big/ \frac{dx}{d\theta}$$

$$\frac{d^2y}{dx^2} = \frac{\frac{d}{d\theta}\left(\frac{dy}{dx}\right)}{\frac{dx}{d\theta}}$$

9 Maximum/minimum
For turning points $f'(x) = 0$
Let $x = a$ be a solution for the above
If $f'(a) > 0$, then a minimum
If $f'(a) < 0$, then a maximum
For points of inflection $f''(x) = 0$
Let $x = b$ be a solution for the above
Test for inflection $f(b - h)$ and $f(b + h)$
Change sign or $f'''(b) \neq 0$ if $f'''(b)$ exists

10 $\frac{d}{dx} \sin^{-1} f(x) = \frac{f'(x)}{\sqrt{1 - [f(x)]^2}}$

11 $\frac{d}{dx} \cos^{-1} f(x) = \frac{-f'(x)}{\sqrt{1 - [f(x)]^2}}$

12 $\frac{d}{dx} \tan^{-1} f(x) = \frac{f'(x)}{1 + [f(x)]^2}$

13 $\frac{d}{dx} \cot^{-1} f(x) = \frac{-f'(x)}{1 + [f(x)]^2}$

14 $\frac{d}{dx} \sec^{-1} f(x) = \frac{f'(x)}{f(x)\sqrt{[f(x)]^2 - 1}}$

15 $\frac{d}{dx} \text{cosec}^{-1} f(x) = \frac{-f'(x)}{f(x)\sqrt{[f(x)]^2 - 1}}$

16 $\frac{d}{dx} \sinh^{-1} f(x) = \frac{f'(x)}{\sqrt{[f(x)]^2 + 1}}$

17 $\frac{d}{dx} \cosh^{-1} f(x) = \frac{f'(x)}{\sqrt{[f(x)]^2 - 1}}$

18 $\frac{d}{dx} \tanh^{-1} f(x) = \frac{f'(x)}{1 - [f(x)]^2}$

19 $\frac{d}{dx} \coth^{-1} f(x) = \frac{f'(x)}{[f(x)]^2 - 1}$

20 $\frac{d}{dx} \text{sech}^{-1} f(x) = \frac{-f'(x)}{f(x)\sqrt{1 - [f(x)]^2}}$

21 $\frac{d}{dx} \text{cosech}^{-1} f(x) = \frac{f'(x)}{f(x)\sqrt{[f(x)]^2 + 1}}$

22 Increments $\delta z = \frac{\partial z}{\partial x} \delta x + \frac{\partial z}{\partial y} \delta y + \frac{\partial z}{\partial w} \delta w$

23 Rate of change

$$\frac{dz}{dt} = \frac{\partial z}{\partial x} \frac{dx}{dt} + \frac{\partial z}{\partial y} \frac{dy}{dt} + \frac{\partial z}{\partial w} \frac{dw}{dt}$$

INTEGRATION

1 By parts $\int u\,dv = uv - \int v\,du$

2 $\int_a^b f(x)dx = F(b) - F(a)$

3 Mean value $= \frac{1}{b-a} \int_a^b y\,dx$

4 $(\text{R M S})^2 = \frac{1}{b-a} \int_a^b y^2\,dx$

TABLE OF INTEGRALS

1 $\int x^n dx = \frac{x^{(n+1)}}{n+1} + c, \quad n \neq -1$	2 $\int (u+v)dx = \int udx + \int vdx$
3 $\int audx = a\int udx$, a a constant	4 $\int [f(x)]^n f'(x)dx = \frac{[f(x)]^{n+1}}{n+1} + c, \; n \neq -1$
5 $\int \frac{f'(x)}{f(x)} dx = \ell n\lvert f(x)\rvert + c$	6 $\int f'(x) e^{f(x)} dx = e^{f(x)} + c$
7 $\int f'(x) a^{f(x)} dx = \frac{a^{f(x)}}{\ell na} + c$	8 $\int f'(x) \sin f(x)dx = -\cos f(x) + c$
9 $\int f'(x) \cos f(x)dx = \sin f(x) + c$	10 $\int f'(x) \tan f(x)dx = \ell n \sec f(x) + c$
11 $\int f'(x) \cot f(x)dx = \ell n \sin f(x) + c$	
12 $\int f'(x) \sec f(x)dx = \ell n [\sec f(x) + \tan f(x)] + c$	
13 $\int f'(x) \operatorname{cosec} f(x)dx = \ell n [\operatorname{cosec} f(x) - \cot f(x)] + c$	
14 $\int f'(x) \sec^2 f(x)dx = \tan f(x) + c$	
15 $\int f'(x) \operatorname{cosec}^2 f(x)dx = -\cot f(x) + c$	
16 $\int f'(x) \sec f(x) \tan f(x)dx = \sec f(x) + c$	
17 $\int f'(x) \operatorname{cosec} f(x) \cot f(x)dx = -\operatorname{cosec} f(x) + c$	
18 $\int f'(x) \sinh f(x)dx = \cosh f(x) + c$	
19 $\int f'(x) \cosh f(x)dx = \sinh f(x) + c$	
20 $\int f'(x) \tanh f(x)dx = \ell n \cosh f(x) + c$	
21 $\int f'(x) \coth f(x)dx = \ell n \sinh f(x) + c$	
22 $\int f'(x) \operatorname{sech}^2 f(x)dx = \tanh f(x) + c$	

23 $\int f'(x)\operatorname{cosech}^2 f(x)dx = -\coth f(x) + c$

24 $\int f'(x)\operatorname{sech} f(x) \tanh f(x)dx = -\operatorname{sech} f(x) + c$

25 $\int f'(x)\operatorname{cosech} f(x) \coth f(x)dx = -\operatorname{cosech} f(x) + c$

26 $\int \frac{f'(x)}{[f(x)]^2 - a^2}dx = -\frac{1}{a}\operatorname{arccoth}\left(\frac{f(x)}{a}\right) + c$

27 $\int \frac{f'(x)}{a^2 - [f(x)]^2}dx = \frac{1}{a}\operatorname{arctanh}\left(\frac{f(x)}{a}\right) + c$

28 $\int \frac{f'(x)}{[f(x)]^2 + a^2}dx = \frac{1}{a}\arctan\left(\frac{f(x)}{a}\right) + c$

29 $\int \frac{f'(x)}{\sqrt{a^2 - [f(x)]^2}}dx = \arcsin\left(\frac{f(x)}{a}\right) + c$

30 $\int \frac{f'(x)}{\sqrt{[f(x)]^2 + a^2}}dx = \operatorname{arcsinh}\left(\frac{f(x)}{a}\right) + c$

31 $\int \frac{f'(x)}{\sqrt{[f(x)]^2 - a^2}}dx = \operatorname{arccosh}\left(\frac{f(x)}{a}\right) + c$

32 $\int f'(x)\sqrt{a^2 - [f(x)]^2}dx = \frac{a^2}{2}\arcsin\left(\frac{f(x)}{a}\right) + \frac{f(x)}{2}\sqrt{a^2 - [f(x)]^2} + c$

33 $\int f'(x)\sqrt{[f(x)]^2 + a^2}dx = \frac{a^2}{2}\ell n\left|f(x) + \sqrt{[f(x)]^2 + a^2}\right| + \frac{f(x)}{2}\sqrt{[f(x)]^2 + a^2} + c$

34 $\int f'(x)\sqrt{[f(x)]^2 - a^2}dx = -\frac{a^2}{2}\ell n\left|f(x) + \sqrt{[f(x)]^2 - a^2}\right| + \frac{f(x)}{2}\sqrt{[f(x)]^2 - a^2} + c$

TABLE OF LAPLACE TRANSFORMS

Study Guide 2 page 20 and page 51	
$f(t)=\mathcal{L}^{-1}\{F(s)\}$	$F(s)=\mathcal{L}\{f(t)\}$
a	$\frac{a}{s}$
t^n	$\frac{n!}{s^{n+1}}, \quad n=1,2,3,$
e^{bt}	$\frac{1}{s-b}$
$\sin at$	$\frac{a}{s^2+a^2}$
$\cos at$	$\frac{s}{s^2+a^2}$
$\sinh at$	$\frac{a}{s^2-a^2}$
$\cosh at$	$\frac{s}{s^2-a^2}$
$t^n e^{bt}$	$\frac{n!}{(s-b)^{n+1}}, \quad n=1,2,3,$
$t\sin at$	$\frac{2as}{(s^2+a^2)^2}$
$t\cos at$	$\frac{s^2-a^2}{(s^2+a^2)^2}$
$t\sinh at$	$\frac{2as}{(s^2-a^2)^2}$
$t\cosh at$	$\frac{s^2+a^2}{(s^2-a^2)^2}$
$e^{bt}\sin at$	$\frac{a}{(s-b)^2+a^2}$
$e^{bt}\cos at$	$\frac{(s-b)}{(s-b)^2+a^2}$
$e^{bt}\sinh at$	$\frac{a}{(s-b)^2-a^2}$
$e^{bt}\cosh at$	$\frac{(s-b)}{(s-b)^2-a^2}$
$H(t-c)$	$\frac{e^{-cs}}{s}$
$H(t-c)F(t-c)$	$e^{-cs}f(s)$
$\delta(t-a)$	e^{-as}
Study Guide 2 page 55	
$\mathcal{L}\{f(t)\}=F(s)$	
$\mathcal{L}\{f'(t)\}=sF(s)-f(0)$	
$\mathcal{L}\{f''(t)\}=s^2F(s)-sf(0)-f'(0)$	
$\mathcal{L}\{f'''(t)\}=s^3F(s)-s^2f(0)-sf'(0)-f''(0)$	