

MATHEMATICS FOR AERO/MECHANICAL ENGINEERS

TUTORIAL SHEET 5

LAPLACE TRANSFORMS

1. Determine the Laplace transforms of the following functions:

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|----------------------------------|----------------------|-----------------------|------------------|
| (a) $\sin 3t$ | (b) $\cos 2t$ | (c) e^{4t} | (d) $6t^2$ |
| (e) $t^2 - 3t + 4$ | (f) $e^{3t} \cos 4t$ | (g) $e^{-2t} \sin 6t$ | (h) e^{3t+1} |
| (i) $e^{-5t}(\cos 3t + \sin 3t)$ | (j) $\sinh 5t$ | (k) $\sin^2 t$ | (l) $\cosh^2 2t$ |

2. Find the inverse transform of the following:

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|--------------------------|-----------------------------|-----------------------------|--|
| (a) $\frac{6}{s}$ | (b) $\frac{1}{s^4}$ | (c) $\frac{5}{s+4}$ | |
| (d) $\frac{1}{2s-3}$ | (e) $\frac{5}{(s-4)^2}$ | (f) $\frac{s-6}{s^2+36}$ | |
| (g) $\frac{3s+4}{s^2+9}$ | (h) $\frac{s-3}{s^2-6s+25}$ | (i) $\frac{s+4}{s^2+2s+10}$ | |

3. Express in partial fractions and hence find the inverse Laplace transform of:

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|--------------------------------------|--------------------------------------|
| (a) $\frac{1}{s(s-2)}$ | (b) $\frac{s+3}{(s-1)(s+1)(s-2)}$ |
| (c) $\frac{22s+16}{(s+1)(s-2)(s+3)}$ | (d) $\frac{s^2-11s+6}{(s+1)(s-2)^2}$ |

4. Determine:

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| (a) $\left\{ \frac{4s^2 - 17s - 24}{s(s+3)(s-4)} \right\}$ | (b) $\left\{ \frac{5s^2 - 4s - 7}{(s-3)(s^2+4)} \right\}$ |
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