MATHEMATICS FOR AERO/MECHANICAL ENGINEERS

TUTORIAL SHEET 4

ORDINARY DIFFERENTIAL EQUATIONS IV

A

Find the values of the constants for which the given functions are particular integrals of the following differential equations:

1 $ax+b;\quad y''+y=2x$

2. $ae^{bx};\quad y''+2y'-8y=2e^{-2x}$

3. $a;\quad y''-5y'-6y=12$

4. $ax^2+bx+c;\quad y''-4y=x^2-3$

5. $a\sin px+b\cos px;\quad y''+9y=2\cos 2x$

B

Obtain particular integrals of the following differential equations and write down the general solutions:

1. $y''-9y=2e^{2x}$

2. $4y''-3y'-y=2$

3. $y''+y=3\cos 2x$

4. $4y''-y=x^2-3x$

5. $y''-6y'-16y=e^{-x}$

6. $y''+2y'+y=\sin 3x$

7. $2y''+y'-3y=\frac{1}{2}x^3$

8. $y''-y'+y=\cos x-\sin x$

9. $y''-4y=e^{-2x}$

10 $y''+2y'+5y=15$

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C

1. Find the solution of the differential equation which models the spring-mass system with $m = 1$, $k = 9$ under the influence of an external force $F(t)= F_0\cos\omega t$, with $F = 80$ and $\omega = 5$ and given the initial conditions $x(0) = x'(0) = 0$

2. Find the transient and steady periodic solutions of the differential equation:

$$x''+2x'+2x=20\cos 2t \qquad \text{with} \qquad x(0)=x'(0)=0$$