出題教師 :劉政湖

建國科技大學 97 學年度　班級: 機械 2 乙 科目: 工程數學上（期中考）考試試題

(每題十分)　班級: 機二乙 學號: 9649062 姓名 吳佳慶

1. $y'' + 25y = 0$

$\lambda^2 + 25 = 0 \quad \lambda = \pm 5i$

$y = C_1 \cos 5x + C_2 \sin 5x$ #

2. $y' = e^x - y$

$y' + y = e^x$

$y = e^{-\int 1 dx}\left[\int e^{\int 1 dx} e^x dx + C\right]$

$y = e^{-x}\left[\int e^{2x} dx + C\right]$

$y = e^{-x}\left[\frac{1}{2}e^{2x} + C\right]$

$y = \frac{1}{2}e^x + Ce^{-x}$ #

3. $y' + y = y^2$

$u = 1 - 2 = -y^{-1} \quad u' = -y^{-2}y' \quad -y^2 \quad u' + y = y^2 \quad u' - y' = 1 \quad u' - u = 1$

$u = e^{\int dx}\left[\int 1 e^{\int -dx} dx + C\right]$

$u = e^x\left[\int e^{-x} dx + C\right]$

$= e^x\left[-e^{-x} + C\right]$

$\frac{1}{y} = 1 + Ce^x$

$y = \frac{1}{1 + Ce^x}$ #

4. $y' = 1$

5. $y' = \sqrt{xy}$

9. $100y'' + 20y' - 99y = 0$

$100\lambda^2 + 20\lambda - 99 = 0$

$(10\lambda + 11)(10\lambda - 9) = 0$

$\lambda = -\frac{11}{10}, \frac{9}{10}$

$y = C_1 e^{-\frac{11}{10}x} + C_2 e^{\frac{9}{10}x}$ #

6. $y'' + y = x^2$

$y' + y = 0$

$\lambda + 1 = 0$

$\lambda = \pm i$

$y_c = C_1 \cos x + C_2 \sin x$

$y_p = Ax^2 + Bx + C \quad 2A + Ax^2 + Bx + C = x^2$

$y_p = 2A + Ax + B \quad A = 1 \quad B = 0$

$2A + C = 0 \quad C = -2 \quad y_p = x^2 - 2$

$y = y_c + y_p$ #

7. $x^2y'' - 6y = 0$

$m(m-1) - 6 = 0$

$m^2 - m - 6 = 0$

$(m-3)(m+2)$

$y = C_1 x^3 + C_2 x^{-2}$ #

8. $y^2 \cos x dx + (4 + 2y \sin x) dy = 0$

10. $y'' + 3y' + 2y = 30e^{2x}$

$y'' + 3y' + 2y = 0$

$\lambda^2 + 3\lambda + 2 = 0$

$(\lambda + 2)(\lambda + 1) = 0$

$\lambda = -2, -1$

$y_c = C_1 e^{-2x} + C_2 e^{-x}$

$y_p = Ae^{2x}$

$y_p' = 2Ae^{2x}$

$y_p'' = 4Ae^{2x}$

$4Ae^{2x} + 6Ae^{2x} + 2Ae^{2x} = 30e^{2x}$

$A = \frac{30}{12} = 2.5$

$\therefore y_p = 2.5e^{2x}$

$y = y_c + y_p$ #

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(每題十分)　班級: 机三乙 學號: 9640198 姓名: 陳治杰

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1. $y'' + 25y = 0$

2. $y' = e^x - y$

3. $y' + y = y^2$

4. $y' = 1$

5. $y' = \sqrt{xy}$

6. $y'' + y = x^2$

7. $x^2 y'' - 6y = 0$

8. $y^2 \cos x dx + (4 + 2y \sin x) dy = 0$

9. $100y'' + 20y' - 99y = 0$

9. $100\lambda^2 + 20\lambda - 99 = 0$

$(10\lambda + 11)(10\lambda - 9)$

$\lambda = -\frac{11}{10}, \frac{9}{10}$

$y = C_1 e^{-\frac{11}{10}x} + C_2 e^{\frac{9}{10}x}$

10. $y'' + 3y' + 2y = 30e^{2x}$

1. $\lambda^2 + 25 = 0$

$\lambda = \pm 5i$

$y = C_1 \cos 5x + C_2 \sin 5x$ #

3. $u = y^{1-2} = y^{-1}$

$\therefore y' = -y^2 u'$

$-y^2 u' + y = y^2$

$u' - y^{-1} = -1$

$u' - u = -1$

$u = e^{\int dx} \left[\int -1 \cdot e^{\int -dx} dx + c\right]$ #

7. $m(m-1) - 6 = 0$

$m^2 - m - 6 = 0$

$m = 3, -2$

$y = C_1 x^3 + C_2 x^{-2}$ #

2. $y = e^{-\int p dx} \left[\int Q \cdot e^{\int p dx} dx + C\right]$

$= e^{-\int dx} \left[\int e^x \cdot e^{\int dx} dx + C\right]$

$= e^{-x} \left[e^{2x} + dx + c\right]$

$= e^{-x} \left[\frac{1}{2} e^{2x} + C\right]$

10. $y'' + 3y' + 2y = 0$

$\lambda^2 + 3\lambda + 2 = 0$

$(\lambda + 2)(\lambda + 1) = 0$

$\lambda = -2, -1$

$y_c = C_1 e^{-2x} + C_2 e^{-x}$

$y_p = Ae^{2x}$

$y'_p = 2Ae^{2x}$

$y''_p = 4Ae^{2x}$

$4Ae^{2x} + 6Ae^{2x} + 2Ae^{2x} = 30e^{2x}$

$A = \frac{30}{12} = \frac{5}{2}$

$\therefore y_p = 2.5e^{2x}$

$y = y_c + y_p$

$= C_1 e^{-2x} + C_2 e^{-x} + \frac{5}{2} e^{2x}$

6.

$y'' + y = 0$

$\lambda^2 + 1 = 0$

$\lambda = \pm i$

$y_c = C_1 \cos x + C_2 \sin x$

$y_p = Ax^2 + Bx + C$

$y'_p = 2Ax + B$

$y''_p = 2A$

$2A + Ax^2 + Bx + C - x^2$

$\therefore A = 1$

$B = 0$

$2A + C = 0$

$\therefore C = -2$

$y_p = x^2 - 2$

$y = y_c + y_p$

4. $\frac{dx}{dy} = 1$

$\int dy = \int dx$

$y = x + C$

$y - x = C$ #

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(每題十分)　班級：電四甲　學號：4410021　姓名：黃聿瑋

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1. $y'' + 25y = 0$

$\lambda^2 + 25 = 0$.
$\lambda = \pm 5i$
$y = C_1 \cos 5x + C_2 \cos 5x$

2. $y' = e^x - y$

$y' + y = e^x$
$y = e^{-\int p dx}\left[\int e^{\int p dx} dx + c\right]$
$= e^{-x}\left[\frac{1}{2}e^{2x} + c\right]$
$y = \frac{1}{2}e^x + ce^{-x}$

3. $y' + y = y^2$

4. $y' = 1$

$\lambda = 1$
$y = x + C_2$

5. $y' = \sqrt{xy}$

6. $y'' + y = x^2$

$y'' + y = 0$　$y_c = C_1 \cos x + C_2 \sin x$
$2A + Ax^2 + Bx + C = x^2$
$\lambda = \pm i$　$A = 1, B = 0$
$C = -2$, $y_p = x^2 - 2$

7. $x^2 y'' - 6y = 0$

$m(m-1) - 6 = 0$
$m^2 - m - 6 = 0$
$m = 3, -2$
$y = C_1 \cos x^3 + C_2 \sin x^{-2}$

8. $y^2 \cos x dx + (4 + 2y \sin x) dy = 0$

9. $100y'' + 20y' - 99y = 0$

$100\lambda^2 + 20\lambda - 99 = 0$.
$\lambda = -\frac{11}{10}, \frac{9}{10}$
$y = C_1 \cos x^{-\frac{11}{10}} + C_2 \sin x^{\frac{9}{10}}$

$y = y_c + y_p$
$= C_1 \cos x + C_2 \sin x + x^2 - 2$

10. $y'' + 3y' + 2y = 30e^{2x}$

3. $y^{-2} = u$
$u =$

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(每題十分)　　班級: 光通四甲　學號: 9441036　姓名: 蕭依廷

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1. $y'' + 25y = 0$

$\lambda^2 + 25 = 0$
$\lambda = 5i$
$y = C_1 \cos 5x + C_2 \sin 5x$ #

2. $y' = e^x - y$

3. $y' + y = y^2$

4. $y' = 1$

$\because \lambda = 0$
$\therefore y = x + C$ #

5. $y' = \sqrt{xy}$

6. $y'' + y = x^2$

$\lambda^2 + 1 = 0$
$\lambda = i$
$y = C_1 \cos x + C_2 \sin x + Ax^2 + Bx + C$
$y' = 2Ax + B$
$y'' = 2A$
$2A + Ax^2 + Bx + C = x^2$
$A = 1$
$B = 0$
$C = -2$

$y = C_1 \cos x + C_2 \sin x + x^2 - 2$ #

7. $x^2 y'' - 6y = 0$

$m(m-1) - 6 = 0$
$m^2 - m - 6 = 0$
$m = 3, -2$

$y = C_1 x^3 + C_2 x^{-2}$ #

8. $y^2 \cos x\,dx + (4 + 2y \sin x)\,dy = 0$

9. $100y'' + 20y' - 99y = 0$

$100\lambda^2 + 20\lambda - 99 = 0$
$(10\lambda + 11)(10\lambda - 9) = 0$
$\lambda = \frac{-11}{10}, \frac{9}{10}$

$y = C_1 x^{\frac{-11}{10}} + C_2 x^{\frac{9}{10}}$

10. $y'' + 3y' + 2y = 30e^{2x}$

$\lambda^2 + 3\lambda + 2 = 0$
$(\lambda + 2)(\lambda + 1) = 0$
$\lambda = -2, -1$

$y_c = C_1 e^{-2x} + C_2 e^{-x}$

$y_p = Ae^{2x}$
$y_p' = 2Ae^{2x}$
$y_p'' = 4Ae^{2x}$

$4Ae^{2x} + 6Ae^{2x} + 2Ae^{2x} = 30e^{2x}$
$\therefore A = \frac{30}{12} = \frac{5}{2}$
$\therefore y_p = \frac{5}{2}e^{2x}$

$y = C_1 e^{-2x} + C_2 e^{-x} + \frac{5}{2}e^{2x}$ #

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(每題十分) 班級: 機二乙 學號: 9640105 姓名: 黃柏鏗

1. $y'' + 25y = 0$ $\lambda^2 + 25\lambda = 0$ $\lambda = \pm 5i$ $y = C_1\cos 5x + C_2\sin -5x$

2. $y' = e^x - y$
$y' + y = e^x$

3. $y' + y = y^2$
$y^2 - y' = y$ $(\lambda - 1)(\lambda + 1) = 0$ $y = C_1\cos x + C_2\sin -x$
$\lambda^2 - \lambda = 0$ $\lambda = \pm i$

4. $y' = 1$
$\lambda = 1$

5. $y' = \sqrt{xy}$

6. $y'' + y = x^2$
$\frac{dy}{dx} + y = x^2$ $y\,dy = x^2\,dx$ $\frac{y^2}{2} = \frac{x^3}{3} + C$
$\int y\,dy = \int x^2\,dx + C$ $3y^2 = 2x^3 + C$
$2x^3 - 3y^2 + C = 0$ #

7. $x^2y'' - 6y = 0$
$x^2\frac{dy}{dx} - 6y = 0$ $-6y\,dy = x^2\,dx$
$-6\int y\,dy = \int x^2\,dx + C$ $-3y^2 = \frac{x^3}{3} + C$
$-9y^2 = x^3 + C$
$x^3 + 9y^2 + C = 0$ #

8. $y^2\cos x\,dx + (4 + 2y\sin x)dy = 0$

9. $100y'' + 20y' - 99y = 0$
$100\lambda^2 + 20\lambda - 99 = 0$
$(10\lambda - 11)(10\lambda + 9) = 0$
$\lambda = \frac{11}{10}, -\frac{9}{10}$
$y = C_1\cos\frac{11}{10}x + C_2\sin -\frac{9}{10}x$

10. $y'' + 3y' + 2y = 30e^{2x}$
$\lambda^2 - 3\lambda + 2 = 0$
$(\lambda - 2)(\lambda - 1) = 0$
$\lambda = 2, 1$ $y = C_1\cos 2x + C_2\sin x$
$y_p = Ax^2 + Bx + C$
$y_p' = 2Ax + B$
$y_p'' = 4A$

$2\overline{)99}$
$3\overline{)33}$
11

16×11
$10 \quad 9$

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(每題十分)　班級: 通四甲　學號: 9441005D　姓名: 陳昱丰

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1. $y''+25y=0$　$r^2+25=0$　$r=\pm 5i$

2. $y'=e^x-y$

3. $y'+y=y^2$　$y^2-y'-y=0$　$r^2-r=0$

4. $y'=1$　$r=\pm i$　$r=1$

5. $y'=\sqrt{xy}$

6. $y''+y=x^2$　$r^2+1=0$

7. $x^2y''-6y=0$　$m(m-1)-6=0$　$m^2-m-6=0$　$m\times -3$　$m\times 2$　$(m-3)(m+2)=0$　$m=3,-2$　$y=C_1x^3+C_2x^{-2}$

8. $y^2\cos x\,dx+(4+2y\sin x)dy=0$

9. $100y''+20y'-99y=0$　$100r^2+20r-99=0$　10×11　10×9　$(10r+11)(10r-9)=0$　$r=-\frac{11}{10},\frac{9}{10}$

10. $y''+3y'+2y=30e^{2x}$　$r^2+3r+2=30e^{2x}$