

元智大學 100 學年度研究所 碩士班 招生試題卷

系(所)別： 機械工程學系碩
士班 組別： 丙組

科目： 工程數學

用紙第 1 頁共 2 頁

● 不可使用電子計算機

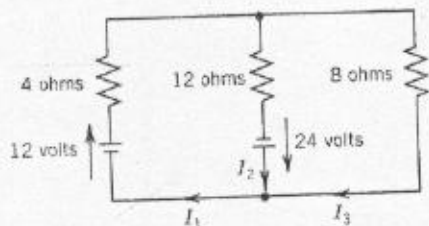
1. Using Variation of Parameters to find a solution of the following equation (16%)

$$x^2 y'' - 3x y' + 4y = \ln x, \quad x > 0$$

2. Using the method of Laplace Transformation to solve the initial value problem of $y(t)$ (17%)

$$y'' + 4y' + 13y = 2e^{-2t} \sin 3t \quad \text{with} \quad y(0) = 1, \quad \left. \frac{dy}{dt} \right|_{t=0} = 0$$

3. Using Kirchhoff's laws, find the currents in the following networks. (10%)



4. Find out what type of conic section (or pair of straight lines) is represented by the given quadratic form $4x_1x_2 + 3x_2^2 = 1$. Transform it to principal axes. Express $\bar{x}^T = [x_1 \ x_2]$ in terms of the new coordinate vector $\bar{y}^T = [y_1 \ y_2]$. (10%)

5. Evaluate $\int_C \vec{F} \cdot \vec{r}' ds$, $\vec{F} = (x^2 + y^2)^{-1}[-y, x, 0]$, $C: x^2 + y^2 = 1, z = 0$, oriented clockwise. (13%)

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6. Use Laplace transformation to solve the P.D.E. problem

$$\frac{\partial w}{\partial x} + x \frac{\partial w}{\partial t} = 0, \quad w(x, 0) = 0, w(0, t) = t$$

$w(x, t) = ?$ (17%)

7. There is periodic square wave with analytic represented as $f(x)$ function

$$f(x) = \begin{cases} -k & \text{when } -\pi < x < 0 \\ k & \text{when } 0 < x < \pi \end{cases} \quad \text{and } f(x+2\pi) = f(x)$$

Please find the Fourier coefficient of a_n, b_n and their series functions to present the $f(x)$ functions. (17%)