國立雲林科技大學
101 學年度碩士班暨碩士在職專班招生考試試題

系所：機械系
科目：工程數學(1)

Prob. 1 (30%)

The model of a motor with input voltage $f(t)$ and output angular velocity y(t) is given as following, $y' + y = f(t)$, with $y(0) = 0$ where $f(t)$ is given in figure 1.

(1) Please solve y(t) by Laplace transform. (15%)

(2) Please solve y(t) by convolution integral (15%)

defined as $\int_0^t g(t-\tau)f(\tau)d\tau$.

Where $g(t)$ is the unit impulse response, that is the solution of $y' + y = \delta(t)$ with the unit impulse function (Dirac delta function) $\delta(t)$.

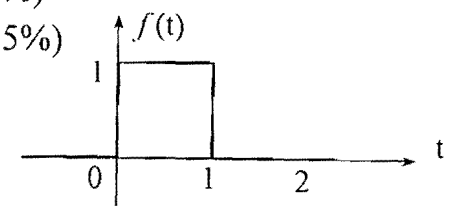

Figure 1

Prob. 2 (20%)

Given an equations as below

$y' + 2y = 2\cos(2x)\sin(4x)$,

please solve its particular solution $y_p(x)$.

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3. Consider the system of linear equations:

$$2X_1 + X_2 - 11X_3 = -6$$
$$-5X_1 + X_2 + 9X_3 = 12$$
$$X_1 + X_2 + 14X_3 = -5$$

The system can be written in matrix form as $AX = B$. Please find (1) A, B, (2) the Rank of matrix A by Gauss elimination, (3) det(A), (4) A^{-1}, (5) $A^{-1}B$, (6) X. (25%)

4. Solve $\frac{\partial u}{\partial t} = 9\frac{\partial^2 u}{\partial x^2}$ for $0 < x < 3, t > 0$

with $u(0,t) = u(3,t) = 0$ for $t \geq 0$; $u(x,0) = 50$ for $0 \leq x \leq 3$ (25%)