國立臺灣科技大學

八十九學年度碩士班招生考試試題

系所組別： 電子工程系乙一組、電子工程系乙二組、電子工程系乙三組、電子工程系丙組

科　目： 工程數學

(總分共 100 分)

(1) Compute $\iint_S \vec{F}\cdot\vec{n}\,d\sigma$, where $\vec{F}(x,y,z) = x^2\hat{i} + 2y\hat{j} + 4z^2\hat{k}$ and S is the surface of the cylinder $x^2 + y^2 \le 4$, $0 \le z \le 2$ (12%)

(2) Let S be the part of the cylinder $z = 1 - x^2$ for $0 \le x \le 1$, $-1 \le y \le 2$ verify stokes' theorem if $\vec{F} = xy\hat{i} + yz\hat{j} + xz\hat{k}$ (12%)

(3) Consider the problem of determining the temperature distribution in a bar extending from zero to infinity if the left end is kept at zero temperature and the initial temperature in the cross-section at x is $f(x)$, where

$$f(x) = \begin{cases} \pi - x & 0 \le x \le \pi \\ 0 & x \ge \pi \end{cases}$$

, solve the problem as the mathematical model is $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$ $(x>0,\ t>0)$, a is constant, t is the time. (14%)

(4) compute $\int_0^\infty \frac{dx}{x^6+1}$. (12%)

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5.Find a general solution of the following equation. (10pts)

$x^2y^{(3)}-6y'=2x^2$

6.Solve the following problem using the Laplace transform. (10pts)

$ty''+(t-3)y'+2y=0,\ y(0)=0$

7.Let the eigenvalues of the following matrix be $\lambda_1, \lambda_2, \lambda_3, \lambda_4$. (10pts)

(a) Find $\lambda_1+\lambda_2+\lambda_3+\lambda_4$.

(b) Find $\lambda_1\lambda_2+\lambda_1\lambda_3+\lambda_1\lambda_4+\lambda_2\lambda_3+\lambda_2\lambda_4+\lambda_3\lambda_4$

$$\begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 3 & 0 & 0 \\ -1 & 1 & 2 & 1 \\ 0 & 2 & 1 & 2 \end{bmatrix}$$

8.Compute the Fourier transform of the following functions (20pts)

(a) $e^{-3t}H(t)$ & $7/(jt+5)\cos t$

(b) $\delta(t)$ & $5\cos 3t$