

國立臺北科技大學 103 學年度碩士班招生考試

系所組別：3620 化學工程與生物科技系生化與生醫工程碩士班乙組

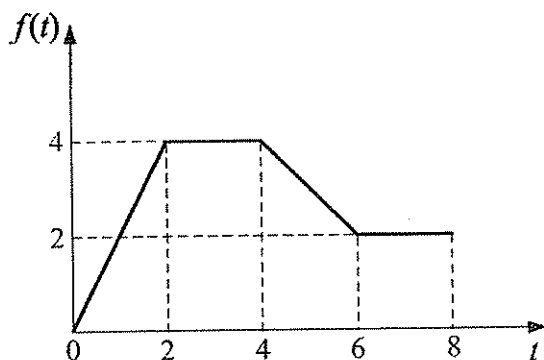
第三節 工程數學 試題

第一頁 共一頁

注意事項：

1. 本試題共 6 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Find the Laplace transform and Fourier transform of the function $f(t)$ shown below. (20%)



2. Solve the differential equation $\frac{dy}{dx} = 3xy - \frac{y(\ln y)}{x}$ by finding an integration factor $I(x, y)$ so that the multiplication of the differential equation by $I(x, y)$ yields an exact differential equation. (15%)
3. Find the general solution of the differential equation $y'' - 2y' + 2y = 2e^x \cos x$. (15%)
4. Use the Laplace transform to solve the following differential equation. (15%)
 $ty'' + (1-3t)y' - 3y = 0, \quad y'(0) = 1$
5. A linear periodic function $f(x)$ has a period 2π and its Fourier series is given by $f(x) = 1 + \sum_{n=1}^{\infty} (-1)^{n+1} \frac{4 \sin(nx)}{n}$. If $f(x)$ is continuous on the interval $-\pi < x < \pi$, what is the analytical expression of $f(x)$? (15%)

6. Let S be the entire surface of a hemispherical region bounded by the hemisphere

$x^2 + y^2 + (z-2)^2 = 4$, $2 \leq z \leq 4$, and C is the boundary of S on the plane $z = 2$. Given

the vector $\vec{F} = (2x + y)\vec{i} + (y + z)\vec{j} + (z - 2)\vec{k}$,

(a) Evaluate the line integral $\oint_C \vec{F} \cdot d\vec{r}$, where \vec{r} is the position vector. (10%)

(b) Evaluate the surface integral $\oiint_S (\vec{F} \cdot \vec{n}) dA$, where \vec{n} is the unit outward normal

vector. (10%)