國立中山大學106學年度碩士暨碩士專班招生考試試題

科目名稱：工程數學【海下所碩士班】　　題號：454001

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

1. (10%) A particle moves on a straight line such that the product of its velocity and acceleration is constant, say, 2 meters^2/sec^3. At time $t = 0$, its displacement from the origin is +5 meters and its velocity is zero. Find its position and velocity at $t = 9$ sec.

2. (10%) Solve the initial value problem:
$(D^2 + 0.5D - 0.5)y = 3\cos x + \sin x + e^x,\ y(0) = 0,\ y'(0) = 1.5$　　Operator $D \equiv \frac{d}{dx}$

3. (10%) Solve the initial value problem:
$y_1' = 2y_2,\quad y_2' = 2y_1,\quad y_1(0) = -9,\quad y_2(0) = 15$

4. (10%) Let $\mathbf{r}(t) = t\mathbf{i} - t^2\mathbf{j}$ be the position vector of a moving particle, where $t\ (\geq 0)$ is time. Find the tangential acceleration and normal acceleration of the particle.

5. (10%) On a mountain, the elevation, in meters, above sea level is $z(x, y) = 1500 - 3x^2 - 5y^2$. What is the direction of steepest ascent at P: $(-0.2,\ 0.1)$?

6. (15%) Find the Fourier transform of the following function,

$$f(\mathrm{x}) = 7e^{-|\mathrm{x}|},\quad -\infty < x < \infty$$

7. (20%) Find the eigenfunction of the following equation:

$$y'' + Ay = 0,\ y(0) = 0,\ y'(L) = 0$$

8. (15%) Find the Fourier series expansion for $f(t) = t^2$, $0 < t < 2\pi$, with $f(t + 2\pi) = f(t)$