淡江大學八十八學年度碩士班招生考試試題

系別：化學工程學系　　科目：工程數學　　本試題共 1 頁

** No credits for using the method not assigned. **

15% 1. Solve

$$y'' + y = \cos(x)\sin(x)$$

15% 2. Transfom

$$y'' + x^4 y = 0$$

into a Bessel equation and write the general solution in terms of Bessel functions.

20% 3. Use the Laplace transform to solve the system of differential equations

$$x' = 2x + y$$
$$y' = y + 6e^{-t} \qquad x(0) = y(0) = z(0) = 0$$
$$z' = 2\sin(t) + x$$

25% 4. Solve the boundary value problem

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial v}{\partial r}\right) = \frac{\partial^2 v}{\partial t^2}$$
$$v(1,t) = 0$$
$$v(r,0) = f(r)$$
$$\frac{\partial v}{\partial t}(r,0) = g(r)$$
$$0 < r < 1, t > 0$$

by separation of variables method.

25% 5. Forced convection heat transfer in a boundary layer with large Prandtl number may be described by the dimensionless equation

$$x\frac{\partial \theta}{\partial z} = \frac{1}{Pe}\frac{\partial^2 \theta}{\partial x^2}$$
$$\theta(0,z) = 1$$
$$\theta(\infty,z) = 0$$
$$\theta(x,0) = 0$$
$$(Pe \equiv Peclet\ no.)$$

Use the combination of variables method to solve the above boundary value problem.