Name _____

Prince of Songkla University

Faculty of Engineering

Midterm Test — Semester 1/2009

1 August 2009 — 9:00-12:00

215-613 Mathematical Methods in Engineering — Room R201

Direction:

1. All types of calculators, document and books are permitted.
2. There are totally 5 problems. Solve all of them.

Total 80 points

Problem #	Full Score	Your mark
1	10	
2	20	
3	20	
4	10	
5	20	
Total	**80**	

Perapong Tekasakul

Instructor

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215-613
Mathematical Methods in Engineering

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1. Describe if the following differential equations are *ordinary* or *partial*, *linear* or *non-linear*, *homogeneous* or *nonhomogeneous*, and give the *order* of the differential equations as well. (10 points)

(a) $2x^2 \frac{dy}{dx} + 2y^2 = x$

(b) $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$

(c) $\frac{d^3 u}{dy^3} - y\left(\frac{d^2 u}{dy^2}\right) = u$

(d) $x^2 \frac{d^4 y}{dx^4} - 3\frac{d^2 y}{dx^2} - y^2 = 1$

(e) $\frac{d^2 y}{dx^2} + \left(\frac{dy}{dx}\right)^{1/2} - 5 = 0$

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2. Solve (20 points)

$$y'' + 2y' + y - e^{-x} = 0$$

$$y(0) = 0$$
$$y'(0) = 1$$

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3. Find a general solution of (20 points)

$$4xy'' + 2y' + y = 0$$

Hint: You may consider using Frobenius method.

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4. Find a general solution of (10 points)

$$x^2y'' + xy' + \left(k^2x^2 - \tfrac{1}{9}\right)y = 0$$

Hint: Use the variable transformation $kx = u$.

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5. The motion of the mass-spring-damper system is described by

$$y'' + 16y = 4\delta(t - \pi)$$

The initial conditions for the system are

$$y(0) = 2 \quad \text{and} \quad y'(0) = 0$$

Determine the response $y(t)$. (20 points)