MEMORIAL UNIVERSITY
DEPARTMENT OF MATHEMATICS

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FALL 2019 **Assignment 1, Stochastic DE** DUE SEP 18, 2019

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**Last Name:** First name: **Student ID:**

1. Solve each of the following equations.

[6] (a) $x^2 y \dfrac{dy}{dx} = e^{\frac{1}{x}} \sec(y)$

[8] (b) $t^2 \dfrac{dy}{dt} - 2t^2 \tan(t) y = 5\sec^2(t), \quad y(\pi) = 0$

[6] (c) $\dfrac{d^4y}{dx^4} - 5\dfrac{d^2y}{dx^2} - 36y = 0$

[4] 2. Determine an integrating factor which will make the equation

$$xy + y^2 + (x + 2y - 1)\frac{dy}{dx} = 0$$

exact.

[8] 3. Use the method of undetermined coefficients to find the general solution of

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - 4y = 15e^{4x} + 16x.$$

[8] 4. Use the method of variation of parameters to find the general solution of

$$x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 6y = \ln(x),$$

given that $y_1 = x^2$ and $y_2 = x^{-3}$ are solutions of the homogeneous equation

$$x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 6y = 0.$$

[8] 5. Find $\lambda$ so that equation $y'' + \lambda y = 0, y(0) = y(1) = 0$ has non-zero solution.

[6] 6. For a sample space $\Omega = \{1, 2, 3, 4, 5, 6\}$. Find two $\sigma$-algebra $\mathbb{F}$. What is the $\sigma$-algebra $\mathbb{F}$ that contains the maximum numbers of subsets.

[8] 7. (1). Find the integral $\int_{-\infty}^{\infty} e^{-x^2} dx$.

(2). Find the expectation and variance of the Normal distribution.

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[62]