Final Version

King Fahd University of Petroleum & Minerals
Department of Mathematics & Statistics
Math 513 Major Exam I
The First Semester of 2014-2015 (141)
Time Allowed: 90 Minutes

Name: _____ ID#: _____

Section/Instructor: _____ Serial #: _____

- Mobiles and calculators are not allowed in this exam.
- Write all steps clear.

Question #	Marks	Maximum Marks
1		12
2		16
3		12
4		14
5		12
6		14
Total		80

Q:1 (12 points) Solve the initial value problem by using Laplace transform

$$y''' - 3y'' + 3y' - y = t^2 e^t; \quad y(0) = 1, y'(0) = 0, y''(0) = -2.$$

Q:2a (8 points) Find the inverse Laplace transform of $F(s) = \frac{1}{s^3(s^2+1)}$.

Q:2b (8 points) Solve the integral equation $f(t) = 8t^2 - 3\int_0^t f(x)sin(t-x)dx$.

Q:3 (12 points) Let $f(t) = e^t$ and $g(t) = H(t-1) - H(t-2)$.

Show that $f(t) * g(t) = \begin{cases} 0 & 0 \le t \le 1 \\ e^{t-1} - 1 & 1 \le t \le 2 \\ e^{t-1} - e^{t-2} & t \ge 2 \end{cases}$

Q:4 (14 points) Find the Fourier series of the function $f(t) = |t|, \quad -\pi \leq t \leq \pi$. Write the series in phase angle form.

Q:5 (12 points) Find the fourier cosine and sine series of $f(t) = e^{kt}$; $0 < t < a$.

Q:6 (14 points) Find the general solution of the ODE:

$$y'' + 4y = \frac{\pi}{2} - \frac{2}{\pi} \sum_{-\infty}^{\infty} \frac{e^{i(2n-1)t}}{(2n-1)^2}$$