KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

Probabilistic Methods in Electrical Engineering
EE 315
Semester 071
FIRST MAJOR

DATE : November 6, 2007

TIME:6:30-8:00 pm

Name: _____

ID : _____

Section # : _____04_____

QUESTION	MARK
1	**/20**
2	**/20**
3	**/10**
4	**/10**
TOTAL	**/60**

Problem 1:

The lifetime (in years) of a device behaves as a random variable with exponential density

$$f_X(x) = e^{-x} u(x).$$

Let A be the event "device lifetime greater than 5 years", and B be the event "device lifetime greater than 10 years". Find:

a) $P(A \cap B)$.

b) $P(A \cap \overline{B})$.

c) $P(A \cup B)$.

d) $P(B \mid A)$.

Problem 2:

A random variable X has a propbabilty density function (pdf) defined by:

$$f_X(x) = \begin{cases} cx(1-x), & 0 \le x \le 1, \\ 0, & \text{elsewhere} \end{cases}$$

1. Find c such that $f_X(x)$ is a valid pdf.
2. Find $F_X(x)$ and sketch it.
3. Find b such that $P[|X| < b] = \frac{1}{2}$.
4. Find $P[X > 0.5 \,|\, 0 < X < 1]$.

Problem 3:

A random voltage V has the density function $f_V(v) = \frac{1}{4}u(v)e^{-v/4}$

a) Calculate the mean value of V.

b) If the voltage is passed through a device that generates the voltage $Y=V^3$, then calculate the expected value of Y.

Problem 4:

An audio amplifier contains six transistors. A technician has determined that two transistors are defective, but he does not know which two. The technician removes three transistors at random and inspects them. Let **X** be the number of defective transistors that the technician finds, where **X** may be 0, 1, or 2.

1. Find the probability density function for **X**.

2. Now if the technician decides to inspect the six transistors by picking one transistor at a time and inspecting it, what is the probability that he will be successful in finding a defective transistor from the second inspection?