UNIVERSITY OF CALGARY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
ENEL697 DIGITAL IMAGE PROCESSING
TEST NO. 2
WINTER 2004 SESSION
4:00 – 5:30 PM, 7 April 2004

Instructions:

1. This is a closed-book, closed-notes test.
2. The use of only a nonprogrammable calculator with no text storage facilities is permitted.
3. Answer all five questions.
4. Total marks = 20.
5. Time permitted = 90 minutes.

Question 1: Prepare a 5×5 image with zero pixel values. Add a square of size 3×3 pixels with value 100 at the center of the image. Apply the subtracting Laplacian operator to the image. Examine the pixel values inside and around the edges of the square. Give reasons for the effects you find.
(5 marks)

Question 2: Derive the modulation transfer function (MTF) of the 3×3 unsharp masking operator.
Explain its characteristics.
(5 marks)

Question 3: Discuss the differences between highpass filtering and high-frequency emphasis filtering in the frequency domain in terms of their
(a) transfer functions, and
(b) effects on image features.
(3 marks)

Question 4: List the steps of computation required in order to perform frequency domain lowpass filtering of an image using the Fourier transform. (No need to give any equation.)
(2 marks)

Question 5: Give the definition of the 3×3 Sobel masks, and explain how they may be used to detect edges of any orientation in an image.
What are the limitations of this approach to edge detection?
What type of further processing steps could help in improving edge representation?
(5 marks)

******