CS7.404: Digital Image Processing – Monsoon 2024
Mid Semester Examination

Max. Marks: 80

Max. Time: 1.5 Hrs

Q1. Select ALL the correct options from the choices or give very short answers.

1. The difference of two gaussian functions, with different σ values, approximates which of the following kernels? **[2 marks]**
   a. Gaussian b. Sinc c. Gabor d. Laplacian of Gaussian e. NOTA

2. The Fourier Transform of a generic Impulse function, $\delta(t - \tau)$, is: **[2 marks]**
   a. An Impulse function b. Sinc function c. Complex sinusoid d. None of the above

3. Aliasing during image capture can be reduced by: _____ **[3 marks]**

4. The two primary ideas that enable a Homomorphic filter to process an images illumination and reflectance components separately are:_____ **[3 marks]**

Q2. Using the sampling theorem, show that the Fourier transform of a signal will be corrupted if the sampling interval, $\Delta T > 2.\mu_{max}$

Q3. If $\mathcal{F}\{h(t)\} = H(\mu)$, derive the Fourier transform of $h(t-\tau)$, i.e., $\mathcal{F}\{h(t-\tau)\}$

Q4. Give the expression for Butterworth low-pass filter. How do you construct a band-pass filter using this? What are the cut-off frequencies in your expression?

Q5. Describe the effects of translation and rotation of an image in the magnitude and phase spectra of its Fourier Transform. Which of the two spectra encodes the structure of the objects better? How can you demonstrate this?

Q6. Give an example application each where a notch-reject and a band-pass filter can be used very effectively to solve a problem. Give brief explanations as to why they are useful.

Q7. Using definitions of morphological operations, prove that dilation operation is commutative. i.e., : $A \oplus B = B \oplus A$

Q8. Show the effect of **opening** the following image with a 3x3 disc structuring element (seen on the right). Foreground pixels are shown in dark.