

**M.Tech. IN ADVANCED INFORMATION
TECHNOLOGY - EMBEDDED SYSTEM DESIGN
(MTECHSD)**

00233 Term-End Examination

June, 2015

**MINE-050 : ADVANCE SIGNAL AND IMAGE
PROCESSING**

Time : 3 hours

Maximum Marks : 100

Instructions to the Candidates :

- (i) *Section I is compulsory. Answer any five questions from Section II.*
- (ii) *Assume suitable data wherever required.*
- (iii) *Draw suitable sketches wherever required.*
- (iv) *Italicized figures to the right indicate maximum marks.*
- (v) *Use of scientific calculator is allowed.*
- (vi) *In questions where program is to be written, Library functions can be used only for reading and displaying an image.*

SECTION I

1. Answer *all* the questions :

$10 \times 3 = 30$

- (a) What are chain codes ? Give their advantages and disadvantages.
- (b) Write a program for computing the 2D DFT of an image.
- (c) List out the differences between RGB and HSV colour spaces.
- (d) State and explain any non-linear spatial filtering techniques.
- (e) Write short notes on Edge Detection Techniques.
- (f) List any two time-frequency analysing techniques with formulas.
- (g) Does the phase distortion occur in wavelet transform analysis or not ? Justify the answer.
- (h) How is the daughter wavelet derived from the mother wavelet ?
- (i) What are the hard and soft thresholding techniques ?
- (j) How is the Gabor extended the Fourier Transform to extract the frequency information along with the timing information of the events in a signal ?

SECTION II

2. Answer *all* the questions :

- (a) List four different ways of generating a shape signature for Fourier boundary description. $2\frac{1}{2}$
- (b) Write the equations for computing the first two statistical moments of an object/region. $2\frac{1}{2}$
- (c) List two different distance functions with equations. $2\frac{1}{2}$
- (d) Write an algorithm for Bit Plane Slicing. $2\frac{1}{2}$
- (e) Give examples for 2-dimensional, 3-dimensional, 4-dimensional and 5-dimensional images. 4

3. Answer the following questions : $5+4+5$

- (a) Write a program to trace the boundary of an object. Object and background must be complementary to each other.
- (b) Why is chain code not considered to be an efficient way of describing an object ?
- (c) Write a program to label all the objects in the image. Also write a program to remove the objects whose area is less than a certain value and keep the objects whose area is greater than 'X'.

4. Write a program and explain the following :

4+5+5

- (a) Temporal median technique in a video sequence.
- (b) Approximate temporal median technique in a video sequence.
- (c) Gaussian Model technique for a video sequence.

5. Write the mathematical equation of a short wave shown in Figure 1. Verify that this satisfies the mathematical conditions of a wavelet to consider it as a wavelet in the wavelet transform analysis.

8+6

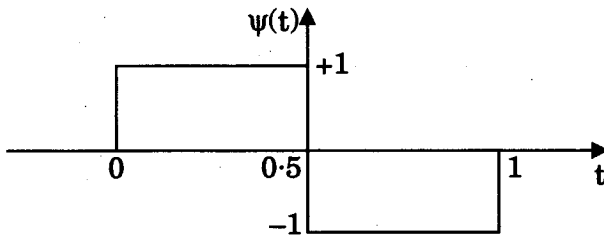


Figure 1

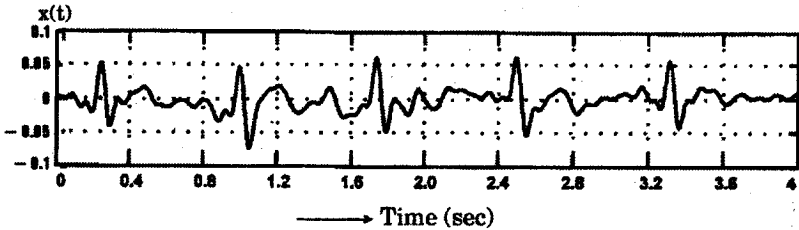
6. (a) What is Short-Time Fourier Transform (STFT) ? How is wavelet transform different from STFT ?

3+4

(b) Verify the function $\psi(t) = (1 - t^2)e^{-t^2/2}$ for the conditions to consider it as wavelet.

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7. In applying the wavelet transforms for the spectral analysis and denoising of the baseline distorted ECG signal shown in the figure given below, which wavelet may be selected and why? Write the program/logical procedure of wavelet transform decomposition and reconstruction of ECG signal $x(t)$ for wavelet based denoising. 6+8



8. What is an edge detector? Describe the typical edge profiles. Differentiate the broad classes of measure of edge sheerness operators from one another with the help of their governing equations. 14
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