# DHARMSINH DESAI UNIVERSITY, NADIAD
## FACULTY OF TECHNOLOGY
## B.TECH CE SEMESTER - VII
## SUBJECT: (CE – 714) IMAGE PROCESSING

| | | | | | |
|---|---|---|---|---|---|
| **Examination** | : | Second Sessional | **Seat No** | : | CE-84 |
| **Date** | : | 4/9/2019 | **Day** | : | Wednesday |
| **Time** | : | 1:45 pm to 3:00 pm | **Max Marks** | : | 36 |

**INSTRUCTIONS:**
1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.



**Q.1 Do as Directed** [12]

(a) Prove that erosion and dilation are duals of each other with respect to set complementation and reflection. [2]

(b) Explain image degradation/restoration process model. [2]

(c) Which factors arise Gaussian noise in an image? [1]

(d) Which type of noise is alleviated by mid-point filter? [1]

(e) Two finite sequences $x = \{x[0], x[1], x[2], x[3]\}$ and $h = \{h[0], h[1], h[2], h[3]\}$ have DFT's given by $X = DFT\{x\} = \{1, j, -1, -j\}$ and $H = DFT\{h\} = \{0, 1 + j, 1, 1 - j\}$. Without computing $x$ and $h$ explicitly find $DFT\{y\}$ and $y[0]$ where $y = x \blacklozenge h$, Where ♦ denotes the circular convolution. [2]

(f) What is the ringing property of Ideal Low Pass Filters? Why is it not observed in Gaussian Low pass filters? [2]

(g) Consider a continuous function $f(t)$ and corresponding sampled function $\tilde{f}(t)$. Prove that Fourier transform of the sampled function $\tilde{f}(t)$ is an *infinite, periodic* sequence of copies of the Fourier transform of a continuous function $f(t)$. [2]

**Q.2 Answer the following questions *(Any Two)*** [12]

(a)
1. Find out the DFT for the sampled function $f(x) = \{j, 0, j, 1\}$ [4]
2. What is Temporal Aliasing? Also briefly describe "Wagon Wheel" effect. [2]

(b) Find out the convolution of two rectangular function f and g. Both are defined in the range 0 to 500. Show the calculation. [6]

| | | |
|---|---|---|
| f(x) : | 20 | $0 < x < 300$ |
| | 0 | elsewhere |
| g(y) : | 40 | $0 < y < 400$ |
| | 0 | elsewhere |

(c)
1. Discuss function reconstruction (recovery) from sampled data. Also prove that between sample points values of the reconstructed function are interpolations formed by the sum of the *sinc* functions. [3]
2. Give Details on the Laplacian in the frequency domain. [3]

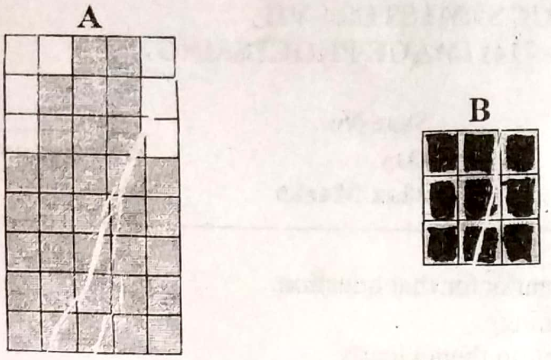
**Q.3 Attempt the following questions** [12]

a) Apply alpha trimmed mean filter on following 8-bit 256 levels 5* 5 image. The value of d is 6 and $S_{xy}$ is the set of coordinates in a rectangular window (neighborhood) of size 3*3. [6]

| Row/Column | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 |
| 2 | 2 | 4 | 6 | 8 | 10 |
| 3 | 3 | 6 | 9 | 12 | 15 |
| 4 | 4 | 8 | 12 | 16 | 20 |
| 5 | 5 | 10 | 15 | 20 | 25 |

Find out the restored pixel value for the $\hat{f}(2,2), \hat{f}(2,4), \hat{f}(3,2), \hat{f}(3,4), \hat{f}(4,2), \hat{f}(4,4)$.

b) Find skeleton of a given set A? Also reconstruct the set from the obtained skeleton. [6]




OR

**Q.3 Attempt the following questions** [12]

**a)** Discuss with example, what you would expect the result to be in each of the following cases.

(1) The starting point of the hole filling algorithm is a point on the boundary of the object. [3]

(2) The starting point in the hole filling algorithm is outside of the boundary. [3]

**b)** (a) What are the advantages of adaptive median filter over traditional median filter? [2]

(b) Discuss the adaptive median filter algorithm in detail. [4]