Birla Institute of Technology and Science, Pilani, Rajasthan
First Semester 2023-2024
Mid-Semester Test (Closed Book)

Course Title: **Pattern Recognition** Course No. **BITS F446**

Time: 90 mins 13-10-2023 Total marks: 30 (30%)

>>>>>>**Read the questions carefully and answer to the point. Symbols are as defined in the class**<<<<<<

Q1. The edge of an object can be extracted using Laplacian. If the digital image is noisy, it needs smoothing prior to the application of Laplacian. The image can be smoothened by using the function, $h(x, y) = 1 - \exp(-\frac{\alpha}{(1+x+y)})$, where α is a non zero constant. Find the Laplacian of the smoothing function. For which value of α, the Laplacian yields zero value at the origin. (Assume: *x* & *y* to be continuous positive variables). **[6+2]**

Q2. A binary image (ideal) contains one pixel wide straight lines oriented horizontally, vertically, at 45^o and at -45^o. Give a set of 3×3 masks that can be used *to detect location of one-pixel-long breaks* in these lines. Find the value of the response *R* which decides location of such breaks? Assume that the gray level of the lines is 255 and the gray level of the background is 0. The lines are well separated. **[7]**

Q3. Develop the mathematical modeling for simulating the illumination map (*i(x,y)*) and extracting the reflectivity map (*r(x,y)*) from an input image (*f(x,y), shown in figure*) degraded by inhomogeneous illumination. Write the mathematical equations for *i(x,y)* and *r(x,y)*. The dimension of the image is 128x128, and the graylevel varies linearly along the horizontal direction (y-axis) and the pixel values at the extreme ends are 0 and 255. **[8]**

Q4. Given an image with the following points on a line: (2, 3), (3, 5), (4, 7), (5, 9), (6, 11), and (7, 13). Using Hough Transform, determine the equation of the line (in normal representation) that best fits these points. **[4]**

Q5. Suggest the most appropriate mask processing filter (name only) to filter the noises (Type A and Type B) as shown in figure below. **[3]**

Noise type - A

Noise type - B

_____All The Best_____