Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: MACHINE VISION AND IMAGE PROCESSING [MTE 4006]

REVISED CREDIT SYSTEM

(29/04/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Define histogram of a grey scale image. A 2 bit grey scale image of size 8x8 is given in Fig.Q1A. Perform histogram equalization on this image and find the pixels in equalized image. Draw histogram plot of the image with and without equalization. **(6)**

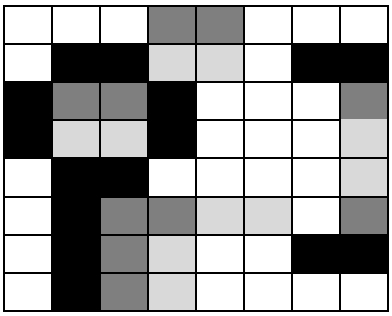

Fig.Q1A

1B. Describe the principle behind stereo vision. In an application for machine vision an image captured by camera is processed using stereo vision techniques and the resultant image is given in Fig.Q1B. Observe the image and identify which part of the image is closer to the camera. Different parts are numbered as 1, 2, 3, 4, 5. Justify your answer with the help of mathematical expression. **(4)**

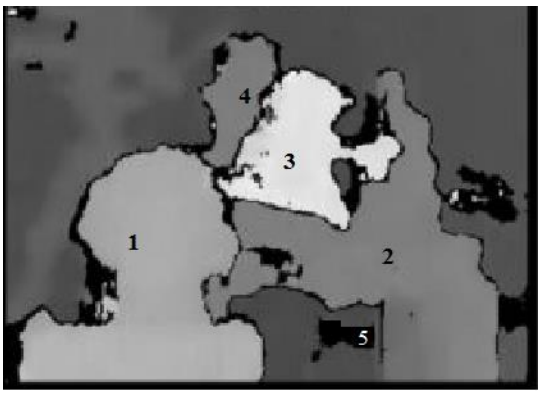

Fig.Q1B

2A. Describe Global edge linking technique using Hough transform. **(5)**

2B. In Fig. Q2B(a) the 'point 1' corresponds to origin of the image. Explain why Hough mapping of 'point 1' is the straight line (shown in Fig. Q2B (b)) in the $(\rho, \theta) plane$. Is this the only point would produce this result and explain the reason for the same? **(2)**

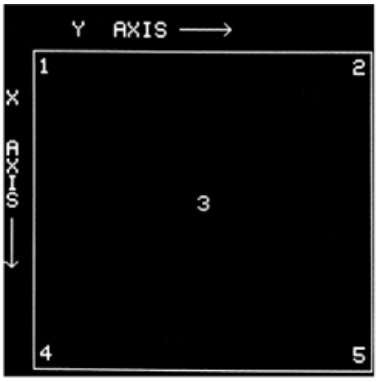

Fig. Q2B(a)

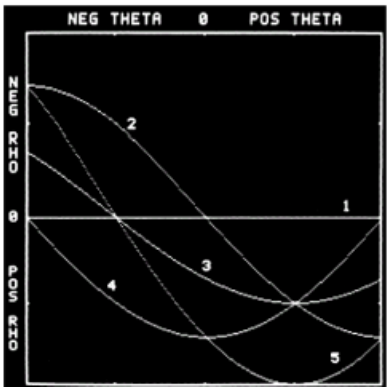

Fig. Q2B(b)

2C. Determine the closing of the binary image shown in Fig. Q2C(a) by the structuring element shown in Fig. Q2C(b) Depict the intermediate stage. Using mathematical expression describe closing operation. **(3)**

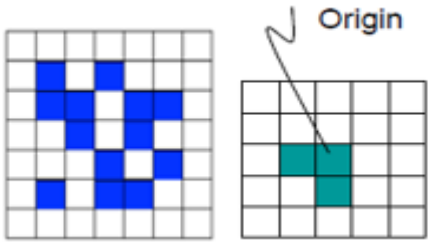

Fig. Q2C (a) Fig. Q2C (b)

3A. Fig. Q3A shows a binary image of fingerprint corrupted by noise. Here the noise consists of light element on a dark background and dark elements on the light background of the fingerprint. Using only morphological operation(s), describe how this noise can be eliminated. Analyze the image shown in Fig. Q3A and determine the series of consecutive mathematical morphology operations. Justify your answer **(3)**

Fig. Q3A

3B. A professor of archeology doing research on currency exchange practices during the Roman Empire recently became aware that four Roman coins are listed in the holdings of British Museum in London. Unfortunately, he was told after arriving there that the coins recently had been stolen but the museum keeps photographs of every item for which it is responsible. Unfortunately, the photos of the coins in question are blurred to the point where the date and other small markings are not readable. The cause of the blurring was the camera being out of focus when the images were taken. As an image processing expert you are asked to Restore the blurred images so that professor can read the markings. You are told that the original camera used to take photos is still available, as are the other representative coins of the same **(3)**

era. Propose a step by step solution to obtain the estimation of the blurred images.

3C. A Fig Q3C (b) is blurred version of Fig. Q3C (a). This blurred image is passed through direct inverse filter, the result obtained is shown in Fig. Q3C(c). The blurred image (Fig. Q3C (b)) is also passed through minimum mean square error filter and the result is shown Fig. Q3C (d). Identify the reason for poor result in Fig. Q3C(c) and describe minimum mean square error filter. **(4)**

Fig. Q3C(a)

Fig. Q3C(b)

Fig. Q3C(c)

Fig. Q3C(d)

4A. Consider the 3 images given below Fig. Q4A (a), Fig Q4A (b), and Fig Q4A(c). The first image is the original image and the next two are processed images. Identify the type of frequency domain filters that have produced the effects in these two images and describe those filters. **(5)**

Fig. Q4A(a)

Fig. Q4A(b)

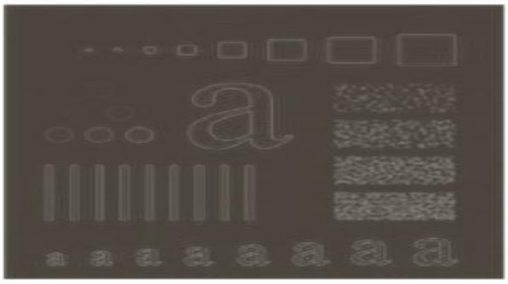

Fig. Q4A(c)

4B. An image shown in Fig. Q4B, is degraded by Gaussian noise. Identify the reason for such a noise in the image? Draw the histogram of Gaussian noise. Comment on the noise present in **(3)**

the image and Propose a spatial domain technique to remove noise present in the image and justify your answer.

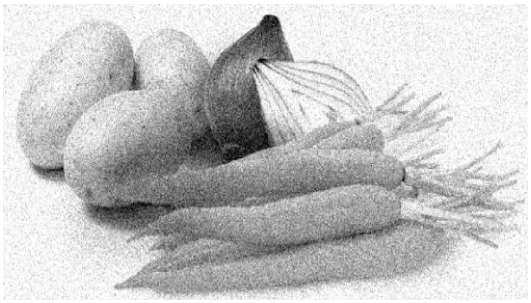

Fig. Q4B

4C. Consider the image segment shown below. Let V= {0,1} and compute the lengths of the shortest 4,8,m path between p and q. If a particular path does not exist between these two points explain the reason for the same. **(2)**

3	1	2	$1(q)$
2	2	0	2
1	2	1	1
$(p)1$	0	1	2

5A. Assume that you are given a job to detect vehicles passing on a given road. Its background is known and all trackable objects look different from the background. Identify the object tracking technique that you should apply and describe the same. **(5)**

5B. To be a good photographer, one must know how to control the exposure of a picture. Describe the various camera parameters which determines how dark or how bright an image is when it is captured by a camera. **(5)**