

Reg. No.



**MANIPAL INSTITUTE OF TECHNOLOGY**  
(Constituent Institute of Manipal University)

MANIPAL-576104



**VI SEMESTER B.TECH (COMPUTER SCIENCE AND ENGINEERING) DEGREE**  
**END SEMESTER MAKEUP EXAMINATION - JULY 2014**  
**SUBJECT: ELECTIVE I – DIGITAL IMAGE PROCESSING (CSE 320)**  
**DATE: 07/07/2014**

TIME: 3 HOURS

MAX. MARKS: 50

**INSTRUCTIONS TO CANDIDATES**

- ANSWER ANY **FIVE** FULL QUESTIONS.

- 1A. Explain how the images are acquired using [04]  
(i) Gamma Rays  
(ii) X Rays  
(iii) Microwaves  
(iv) Radiowaves
- 1B. Describe the process of Digitization of an image. [03]
- 1C. How do you define spatial and intensity resolution of an image? What happens if these resolutions are varied? Suggest minimum possible spatial and intensity resolution for proper visualization by humans. [03]
- 2A. With respect to histogram processing, explain histogram specification. [04]
- 2B. Explain the following intensity transformation functions. [02]  
(i) Bit plane slicing  
(ii) Gray level slicing
- 2C. Explain the concept of spatial filtering for image enhancement. [04]
- 3A. Give the mathematical formulation for fourier transform pair  $f(x,y)$  and  $F(u,v)$ . Also show that at  $u=v=0$ , Fourier transform is equal to the average gray level of the image. [02]
- 3B. Give the steps involved in filtering an image in frequency domain. Also list out the properties of frequency domain filtering. [04]
- 3C. Explain Homomorphic filtering. [04]

- 4A. Prove that morphological dilation and erosion are duals of each other with respect to the set complementation and reflection. Also provide any three properties of each. [03]
- 4B. Consider the simple 4×8, 8-bit image:
- |    |    |    |    |     |     |     |     |
|----|----|----|----|-----|-----|-----|-----|
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
- (i) Compute the entropy of the image.
- (ii) Compress the image using Huffman coding.
- (iii) Compute the compression achieved and effectiveness of Huffman coding. [04]
- 4C. Explain the following types of redundancies.
- (i) Coding (ii) Interpixel (iii) Psychovisual [03]
- 5A. Derive an optimal threshold by maximizing in between class variance using Otsu's method. Consider PDFs of object and background as Gaussian. [05]
- 5B. State the basic properties of region based segmentation. Explain region growing, region merging and region splitting methods. [03]
- 5C. Explain Marr-Hildreth edge detector. [02]
- 6A. How does operations like dilation and erosion are used in image smoothing, finding gradient, Top-hat and Bottom-hat transformations of gray scale image? [03]
- 6B. Describe three types of order statistic filters. [03]
- 6C. Depict a model of image degradation/restoration process. [04]

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