


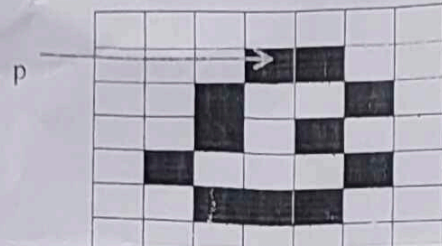


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|  | | SOMAIYA VIDYAVIHAR UNIVERSITY | |
| Maximum Marks: 100 | | Semester:— January 2025 – April 2025 | |
| Programme code: 01 | | Examination: ESE Examination | |
| Programme: UG (BTech) | | Class: TY | Semester: VI(SVU 2020) |
| Name of the Constituent College/ School | | Name of the department: Computers | |
| K. J. Somaiya School of Engineering | | | |
| Course Code: 116U01C601 | Name of the Course: Digital Signal and Image Processing | | |
| Instructions: 1) Draw neat diagrams 2) All questions are compulsory | | | |
| 3) Assume suitable data wherever necessary | | | |

| Que. No. | Question | Max. Marks | | | | | | | | | | | | | | | | |
|----------|---|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 | | | | | | | | | | | | | | | | |
| Q1 | Solve any Four | 5 | | | | | | | | | | | | | | | | |
| i) | Determine whether the discrete-time signal is periodic or non-periodic: $x(n) = \cos\left(\frac{3\pi n}{4}\right)$ | 5 | | | | | | | | | | | | | | | | |
| ii) | Prove that DFT matrix is symmetric? Justify your answer. | 5 | | | | | | | | | | | | | | | | |
| iii) | What is the role of a mask (or kernel) in spatial filtering? Explain with an example. | 5 | | | | | | | | | | | | | | | | |
| ix) | Compute Walsh transform of the given image. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>2</td><td>1</td><td>2</td><td>1</td></tr> <tr> <td>1</td><td>2</td><td>3</td><td>2</td></tr> <tr> <td>2</td><td>3</td><td>4</td><td>2</td></tr> <tr> <td>1</td><td>2</td><td>3</td><td>2</td></tr> </table> | 2 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 2 | 3 | 4 | 2 | 1 | 2 | 3 | 2 | 5 |
| 2 | 1 | 2 | 1 | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 2 | | | | | | | | | | | | | | | |
| 2 | 3 | 4 | 2 | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 2 | | | | | | | | | | | | | | | |
| v) | What effect would set to zero the lower order 2 bits in 4BPP image planes have on the histogram of an image in general? | 5 | | | | | | | | | | | | | | | | |
| vi) | Determine whether signal is energy signal or power signal: $x(n) = \cos\left(\frac{\pi n}{4}\right)$ | 5 | | | | | | | | | | | | | | | | |
| vii) | Explain morphological opening and closing | 5 | | | | | | | | | | | | | | | | |

| Que. No. | Question | Max. Marks |
|----------|---|------------|
| Q2 A | Explain Homomorphic filter in detail with necessary derivation and example. | 10 |
| | OR | |
| Q2 A | Given the following 5×5 grayscale image, apply a 3×3 median filter to all pixels except the border pixels. $I = \begin{bmatrix} 10 & 200 & 10 & 200 & 10 \\ 200 & 255 & 50 & 255 & 200 \\ 10 & 50 & 0 & 50 & 10 \\ 200 & 255 & 50 & 255 & 200 \\ 10 & 200 & 10 & 200 & 10 \end{bmatrix}$ | 10 |

| | | |
|-------|---|----------|
| Q 2 B | Solve | |
| i) | An 8 point sequence is given by $x(n) = [1, 1, 1, 1, 0, 0, 0, 0]$. Compute 8-point DFT of $x(n)$ by radix-2 DIT-FFT. | 10 10 |

| Que. No. | Question | Max. Marks | | | | | | | | | | | | | | | | |
|----------|--|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| Q3 | Solve any Two | 20 | | | | | | | | | | | | | | | | |
| i) | <p>For a 3 BPP 4×4 size image, perform the following operations: 3 BPP Image</p> <ul style="list-style-type: none">a) Negationb) Thresholding with $T=4$c) Intensity level slicing with background $r1 \geq 2$ and $r2 \leq 5$d) Bit plane slicing for MSB and LSB planese) Clipping with $r1=2$ and $r2=5$ <table><tr><td>1</td><td>2</td><td>3</td><td>0</td></tr><tr><td>2</td><td>4</td><td>6</td><td>7</td></tr><tr><td>5</td><td>2</td><td>4</td><td>3</td></tr><tr><td>3</td><td>2</td><td>6</td><td>1</td></tr></table> | 1 | 2 | 3 | 0 | 2 | 4 | 6 | 7 | 5 | 2 | 4 | 3 | 3 | 2 | 6 | 1 | 10 |
| 1 | 2 | 3 | 0 | | | | | | | | | | | | | | | |
| 2 | 4 | 6 | 7 | | | | | | | | | | | | | | | |
| 5 | 2 | 4 | 3 | | | | | | | | | | | | | | | |
| 3 | 2 | 6 | 1 | | | | | | | | | | | | | | | |
| ii) | <p>Compute the discrete cosine transform (DCT) of the following sequence:</p> $f(x) = \{1, 2, 4, 7\}$ | 10 | | | | | | | | | | | | | | | | |
| iii) | <p>Given an image write down the 8 chain code, all the iterations have to be drawn and written down clearly.</p>  | 10 | | | | | | | | | | | | | | | | |

| Que. No. | Question | Max. Marks |
|----------|---|------------|
| Q4 | Solve any Two | 20 |
| i) | Describe JPEG compression in detail with necessary block diagram | 10 |
| ii) | Given four points in xy plane with the following coordinates (1,1), (2,2), (3,3), (4,4) use Hough transform to join these points. | 10 |
| iii) | Write down the masks for different edge detecting operators and their significance: <ol style="list-style-type: none"> Roberts Mask Prewitt Mask Compass Operators Sobel Mask | 10 |

| Que. No. | Question | Max. Marks |
|----------|---|------------|
| Q5 | (Write notes / Short question type) on any four | 20 |
| i) | Hit and Miss Transform | 5 |
| ii) | Compare and contrast point and neighbourhood spatial domain enhancement techniques. | 5 |
| iii) | Hoteling Transform | 5 |
| iv) | Vector Quantization | 5 |
| v) | Region Split and Merge based segmentation | 5 |
| vi) | Interpixel redundancy | 5 |