CBCS SCHEME

USN

BMT714A

## Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
# Digital Image Processing and Robot Vision

Time: 3 hrs. Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.*
*2. M : Marks , L: Bloom's level , C: Course outcomes.*

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>Explain the fundamental stages of Digital Image Processing using a neat diagram.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Illustrate the application of DIP technique to improve image quality in Gamma and X-Ray imaging.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><td colspan="6"><b>OR</b></td></tr>
<tr><td>Q.2</td><td>a.</td><td>Explain the main components of an image processing system with a block diagram.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Describe how you would apply the concept of image sensing and acquisition using sensor arrays to capture high resolution images of Earth's surface.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><td colspan="6"><b>Module – 2</b></td></tr>
<tr><td>Q.3</td><td>a.</td><td>Apply Contrast stretching and Gray level slicing technique to a satellite image and explain how these transformations improve visual interpretation.</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Given two histograms (i) and (ii) for an 8-level gray scale image<br>Histogram (i)
<table>
<tr><td>Gray levels</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Number of pixels</td><td>790</td><td>1023</td><td>850</td><td>656</td><td>329</td><td>245</td><td>122</td><td>81</td></tr>
</table>
Histogram (ii)
<table>
<tr><td>Gray levels</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Number of pixels</td><td>0</td><td>0</td><td>0</td><td>614</td><td>819</td><td>1230</td><td>819</td><td>614</td></tr>
</table>
Perform histogram matching to modify histogram (i) so that it matches histogram (ii). Show all calculations and provide the final mapping to gray levels.</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6"><b>OR</b></td></tr>
<tr><td>Q.4</td><td>a.</td><td>Perform 1D correlation and convolution of filter with a discrete unit impulse.<br>origin ↓<br>Function : 0 0 0 1 0 0 0 0<br>Mask (w) : 1 2 3 2 8</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Apply Negative transformation to a dark image and explain how it enhances hidden details compared to the original.</td><td>10</td><td>L3</td><td>CO2</td></tr>
</table>

<table>
<tr><td colspan="6"><b>Module – 3</b></td></tr>
<tr><td><b>Q.5</b></td><td><b>a.</b></td><td>Explain the image sharpening using frequency domain filters.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO3</b></td></tr>
<tr><td></td><td><b>b.</b></td><td>Discuss the functional block diagram for pseudo color image processing.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO3</b></td></tr>
<tr><td colspan="6"><b>OR</b></td></tr>
<tr><td><b>Q.6</b></td><td><b>a.</b></td><td>Using a chromaticity diagram, show how you would determine color composition of a given light sources.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO3</b></td></tr>
<tr><td></td><td><b>b.</b></td><td>Explain the purpose of homomorphic filtering in image processing. How does it enhance both the brightness and contrast of an image?</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO3</b></td></tr>
<tr><td colspan="6"><b>Module – 4</b></td></tr>
<tr><td><b>Q.7</b></td><td><b>a.</b></td><td>Explain the different types of data redundancy.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO4</b></td></tr>
<tr><td></td><td><b>b.</b></td><td>Calculate Huffman code for following symbols.
<table>
<tr><th>Symbol</th><th>Probability</th></tr>
<tr><td>$a_2$</td><td>0.4</td></tr>
<tr><td>$a_6$</td><td>0.3</td></tr>
<tr><td>$a_1$</td><td>0.1</td></tr>
<tr><td>$a_4$</td><td>0.1</td></tr>
<tr><td>$a_3$</td><td>0.06</td></tr>
<tr><td>$a_5$</td><td>0.04</td></tr>
</table></td><td><b>10</b></td><td><b>L3</b></td><td><b>CO4</b></td></tr>
<tr><td colspan="6"><b>OR</b></td></tr>
<tr><td><b>Q.8</b></td><td><b>a.</b></td><td>Explain a lossy predictive coding model encoder and decoder.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO4</b></td></tr>
<tr><td></td><td><b>b.</b></td><td>Apply run-length coding techniques to the sample binary image.
<table>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
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</table></td><td><b>10</b></td><td><b>L3</b></td><td><b>CO4</b></td></tr>
<tr><td colspan="6"><b>Module – 5</b></td></tr>
<tr><td><b>Q.9</b></td><td><b>a.</b></td><td>Explain optical proximity sensor with a neat diagram.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO5</b></td></tr>
<tr><td></td><td><b>b.</b></td><td>Illustrate Edge linking and boundary detection.</td><td><b>10</b></td><td><b>L3</b></td><td><b>CO5</b></td></tr>
<tr><td colspan="6"><b>OR</b></td></tr>
<tr><td><b>Q.10</b></td><td><b>a.</b></td><td>Describe camera model imaging geometry with two coordinate systems.</td><td><b>10</b></td><td><b>L2</b></td><td><b>CO5</b></td></tr>
<tr><td></td><td><b>b.</b></td><td>Illustrate region based segmentation technique with an example.</td><td><b>10</b></td><td><b>L3</b></td><td><b>CO5</b></td></tr>
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