भारतीय प्रौद्योगिकी संस्थान जम्मू
INDIAN INSTITUTE OF TECHNOLOGY JAMMU

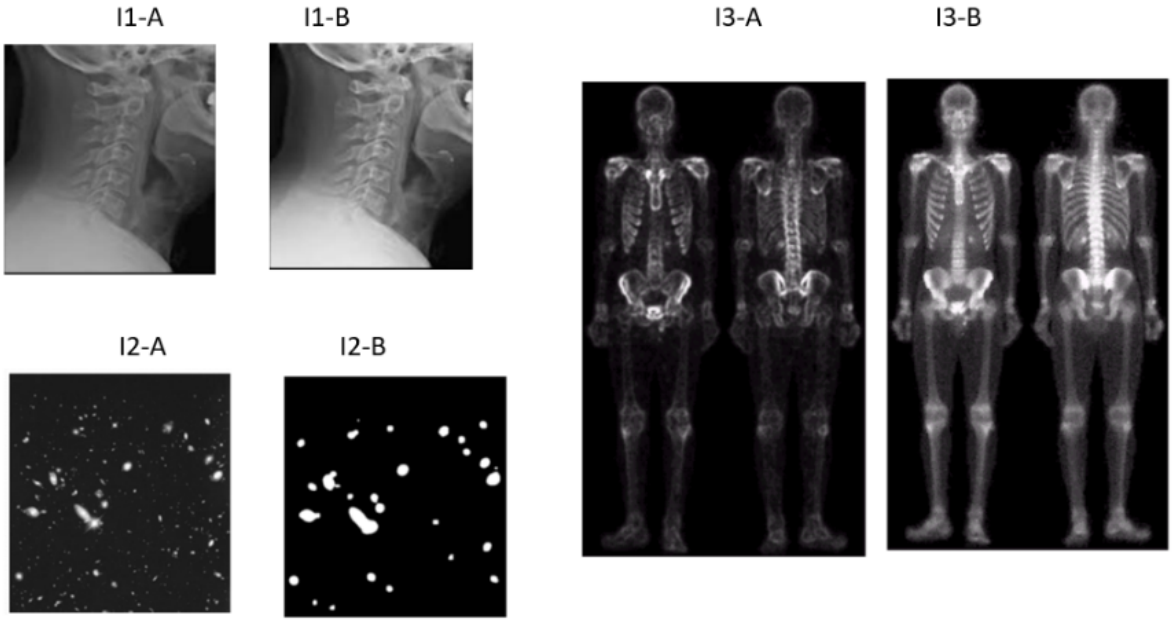
Discipline of
Computer Science & Engineering

END SEM - Executive M.Tech
Course: Image Processing **Date: 21 OCT 2023**

---

1. E-mail, LMS (or any other method) submission will NOT be accepted.
2. Penalties for late assignment submission — 10% of the total marks awarded will be deducted for each 10 minutes.
3. Ensure that your submission consists of a single PDF file. Note that any files in ZIP or JPG format will not be considered during evaluation.
4. Formulate any necessary assumptions for the assignment.

1. (6 points) Given three sets of image and their transformed versions. Suggest which steps of operations would have been performed to transform from A to B.



2. (8 points) In photography, it is often desired to process the captured image that decreases the background noise and output the sharped results.

- Describe the construction of a composite 3x3 spatial filter mask that implements the above operation for you.[2]
- Compute Fourier transform H(ω_1, ω_2) of the filter.[3]
- Plot sketch the one dimensional profiles $H(\omega_1, 0)$, $H(\omega_1, \pi)$, and $H(0, \omega_2)$, $H(\pi, \omega_2)$. Use extra points as required. Explain the function of the filter profile in horizontal and vertical directions.[3]

3. (6 points) Given an actual image ($f(x, y)$) and its smoothed version ($f'(x, y)$), the unsharp version of the image can be generated as $fs(x, y)$ using the mathematical given below:

   $fs(x, y) = f(x, y) - f'(x, y)$
   $f_{sharped} = f(x, y) + fs(x, y)$

10	10	10	10
10	216	210	10
10	209	150	10
10	10	10	10

Figure-1

   Apply unsharp masking on 4x4 image given in figure-1 and draw final sharped image $f_{sharped}$. Use box filter for smoothing.

4. (15 points) Given an 5x5 image in 3-bits (gray levels between 0-7)

3	1	7	3	2
7	7	7	6	1
7	6	2	5	4
6	6	7	5	4
5	5	4	4	1

- Compute the entropy of the image shown above and the feasibility of using Huffman coding for compression purposes.[3]
- Compute the Huffman codes for each of the symbols. Also show the coding tree.[4]

- If we perform histogram equalization (HE) then how will the entropy and Huffman coding structures will change? [3+3+2] (show all necessary steps including HE and Huffman coding with tree+explanation)