Additional Suggestive list of Practical's (can be implemented in C++/Python)

1. Write a program to implement DFAs that recognize identifiers, constants, and operators of the mini language.
2. Write a program to design a Lexical analyzer for the above language. The lexical analyzer should ignore redundant spaces, tabs and newlines. It should also ignore comments. Identifiers may be of restricted length.
3. Write a program to check the types of expressions in a language.
4. Write a translator to translate a 3-address code into assembly code.

COMMON POOL OF DISCIPLINE ELECTIVE COURSES (DSE) COURSES

Computer Science Courses for all Undergraduate Programmes of study with Computer Science as Discipline Elective

DISCIPLINE-SPECIFIC ELECTIVE COURSE: DIGITAL IMAGE PROCESSING

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSE7a: Digital Image Processing	**4**	**3**	**0**	**1**	Pass in Class XII	One course in any Programming Language

Course Objective

This course introduces students to the fundamentals of digital image processing, It introduces image processing in the Spatial and frequency domains including techniques for various image

transformations, image enhancement/filtering, image restoration, image compression and segmentation and morphological image processing.

Course Learning Outcomes

On successful completion of the course, students will be able to:

1. Understand the fundamentals of Image Processing and its role and importance in a variety of applications.
2. Write programs to read/write and manipulate images for the purpose of enhancement.
3. Understand the need for image transforms and their properties.
4. Understand different causes for image degradation and use various techniques to restore images.
5. Understand the need and techniques for image compression.
6. Perform morphological image processing and image segmentation.
7. Develop an image processing application.

Syllabus

Unit 1 Introduction **(5 hours)**

Digital Image Fundamentals, Brightness, Adaptation and Discrimination, Light and Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships between Pixels Types of images.

Unit 2 Spatial Domain Filtering **(10 hours)**

Some Basic Intensity Transformation Functions, Histogram Equalization, Spatial Correlation and Convolution, Smoothening Spatial Filters-Low pass filters, Order Statistics filters; Sharpening Spatial Filters- Laplacian filter.

Unit 3 Filtering in Frequency Domain **(6 hours)**

The Discrete Fourier Transformation (DFT), Frequency Domain Filtering:-Ideal and Butterworth Low pass and High pass filters

Unit 4 Image Degradation/Restoration Process **(4 hours)**

Noise models, Noise Restoration Filters

Unit 5 Image Compression **(5 hours)**

Fundamentals of Image Compression, Huffman Coding, Run Length Coding

Unit 6 Morphological Image Processing **(10 hours)**

Erosion, Dilation, Opening, Closing, Hit-or-Miss Transformation, Basic Morphological Algorithms.

Unit 7 Image Segmentation **(5 hours)**

Point, Line and Edge Detection, Thresholding.

References

1. Gonzalez, R. C., & Woods, R. E. *Digital Image Processing*, 4th edition, Pearson education, 2017 .

Additional References

1. Castleman, K. R. *Digital Image Processing*, 1st edition, Pearson Education,2007.
2. Gonzalez, R. C., Woods, R. E., & Eddins, S. *Digital Image Processing using MATLAB*, Pearson Education Inc., 2004.
3. Jain, A. K. *Fundamentals of Digital Image Processing*, 1st edition, Prentice Hall of India,1988.

Suggested Practical List

The practicals are to be conducted using Python. The objective is to become familiar with basic Python libraries for Image Processing, like OpenCV, Scikit-Image, etc.

1. Perform the following:
    a. Read and display an image.
    b. Resize a given image.
    c. Convert a given color image into a corresponding gray-scale image.
    d. Convert a given color/gray-scale image into black & white image
    e. Draw the image profile.
    f. Separate a given color image into three RG & B planes.
    g. Create a color image using separate three R, G and B planes.
    h. Write given 2-D data in an image file.

2. To write and execute image processing programs using point processing method:
    a. Obtain Negative image
    b. Obtain Flip image
    c. Thresholding
    d. Contrast stretching
3. To write and execute programs for image arithmetic operations:
    a. Addition of two images
    b. Subtract one image from other image
    c. Calculate mean value of image
    d. Different Brightness by changing mean value
4. To write and execute programs for image logical operations:
    a. AND operation between two images
    b. OR operation between two images
    c. Calculate intersection of two images
    d. Water Marking using X-OR operation
    e. NOT operation (Negative image)
5. To write and execute a program for histogram calculation and equalization:
    a. Using inbuilt function
    b. Without using inbuilt function
6. To write and execute a program performing the following geometric transformations on an image:
    a. Translation
    b. Scaling
    c. Rotation
    d. Shrinking
    e. Zooming
7. To understand various image noise models and to write programs for:
    a. Image restoration
    b. Remove Salt and Pepper Noise
    c. Minimize Gaussian noise
    d. Median filter and Weiner filter
8. Write and execute programs to remove noise from images using spatial filtering.
    a. Understand 1-D and 2-D convolution process

b. Use 3x3 Mask for low pass filter and high pass filter

9. Write and execute programs for image frequency domain filtering.
   a. Apply FFT on given image
   b. Perform low pass and high pass filtering in frequency domain
   c. Apply IFFT to reconstruct image
10. Write and execute a program for edge detection using different edge detection mask.
11. Write and execute a program for image morphological operations erosion and dilation

DISCIPLINE SPECIFIC ELECTIVE COURSE: Advanced Algorithms

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSE7b: Advanced Algorithms	**4**	**3**	**1**	**0**	Pass in Class XII	Design and Analysis of Algorithms

Course Objective

This course is designed to provide exposure to more sophisticated algorithms for some tractable problems, some advanced topics in algorithms such as NP Completeness and how to handle NP hard problems in practice.

Learning Outcomes

On successful completion of the course, students will be able to:

1. Understand and develop more sophisticated algorithms using some of the known design techniques.
2. Identify NP hard problems.