Aim:

To study the concepts of Filtering and applying the following filters on an image

1. **Low pass filter**
2. **High pass filter**
3. **Median filter**

1) Low Pass Filter

Input Image:

Code:

```
import cv2
import numpy as np

# Load the image
image = cv2.imread('spnoise.jpeg', cv2.IMREAD_GRAYSCALE)

# Define the 3x3 and 5x5 low pass filter masks
mask_3x3 = np.ones((3, 3), dtype=np.float32) / 9
mask_5x5 = np.ones((5, 5), dtype=np.float32) / 25

# Apply the 3x3 and 5x5 low pass filters
filtered_image_3x3 = cv2.filter2D(image, -1, mask_3x3)
filtered_image_3x3=cv2.resize(filtered_image_3x3,(256,256))
filtered_image_5x5 = cv2.filter2D(image, -1, mask_5x5)
filtered_image_5x5=cv2.resize(filtered_image_5x5,(256,256))

# Display the original image and filtered images
cv2.imshow('Original Image', image)
cv2.imshow('Filtered Image (3x3)', filtered_image_3x3)
cv2.imshow('Filtered Image (5x5)', filtered_image_5x5)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Output:

2) High Pass Filter

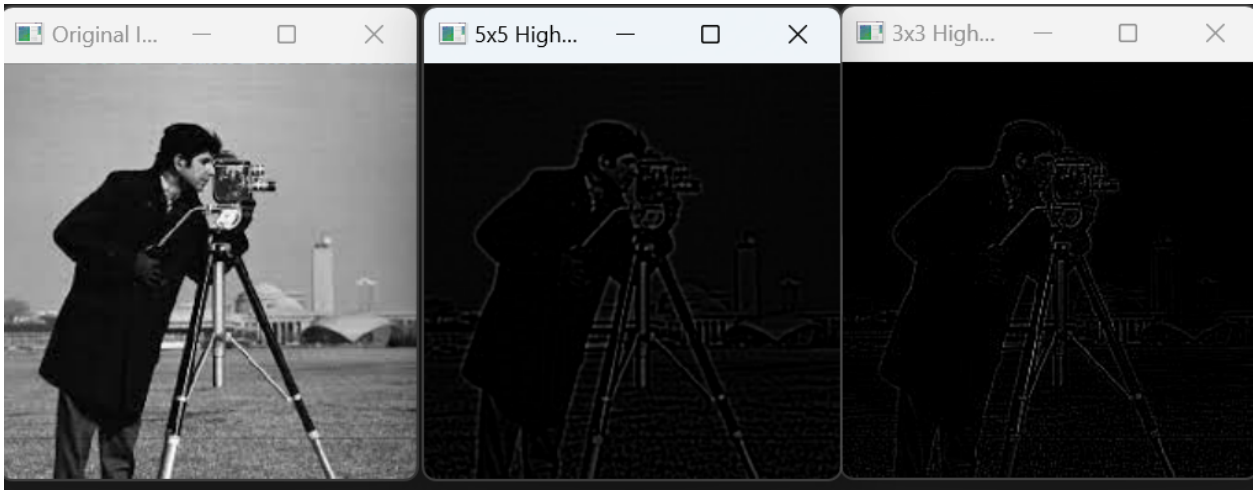
Input Image:

Code:

```
import cv2
import numpy as np

# Load the image
image = cv2.imread('cam.jpeg', cv2.IMREAD_GRAYSCALE)
```

```
# Define the 3x3 and 5x5 high-pass filter masks
mask_3x3 = np.array([[-1, -1, -1],
                     [-1,  8, -1],
                     [-1, -1, -1]], dtype=np.float32)

mask_5x5 = np.array([[-1, -1, -1, -1, -1],
                     [-1,  1,  1,  1, -1],
                     [-1,  1,  9,  1, -1],
                     [-1,  1,  1,  1, -1],
                     [-1, -1, -1, -1, -1]], dtype=np.float32)

# Normalize the filter masks to make sure the sum of the weights is 1
mask_3x3 /= 9
mask_5x5 /= 25

# Apply the 3x3 and 5x5 high-pass filters using OpenCV's filter2D function
filtered_image_3x3 = cv2.filter2D(image, -1, mask_3x3)
filtered_image_5x5 = cv2.filter2D(image, -1, mask_5x5)

# Convert the filtered images back to uint8 format
filtered_image_3x3 = cv2.convertScaleAbs(filtered_image_3x3)
filtered_image_5x5 = cv2.convertScaleAbs(filtered_image_5x5)

# Display the original and filtered images
cv2.imshow('Original Image', image)
cv2.imshow('3x3 High-Pass Filtered Image', filtered_image_3x3)
cv2.imshow('5x5 High-Pass Filtered Image', filtered_image_5x5)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Output:



3) Median Filter

Input Image:

Code:

```
import cv2
import numpy as np

# Load the image
image = cv2.imread('cam.jpeg', cv2.IMREAD_GRAYSCALE)

# Define the 3x3 and 5x5 median filter masks
ksize_3x3 = 3
ksize_5x5 = 5

# Apply the 3x3 and 5x5 median filters using OpenCV's medianBlur function
filtered_image_3x3 = cv2.medianBlur(image, ksize_3x3)
filtered_image_5x5 = cv2.medianBlur(image, ksize_5x5)
```

```
# Display the original and filtered images
cv2.imshow('Original Image', image)
cv2.imshow('3x3 Median Filtered Image', filtered_image_3x3)
cv2.imshow('5x5 Median Filtered Image', filtered_image_5x5)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Output: