L.J Institute of Engineering and Technology, Ahmedabad
Computer Vision Practice Book (SEM-VII-2025 CSE/IT Engineering)

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
UNIT1- INTRODUCTION TO COMPUTER VISION								
TOPIC NAME:- Overview of Computer Vision,Basics of Image Representation,Image Formation(MCQS)								
1	1	Computer vision primarily deals with	B	1	Natural language processing	Image and video processing	Speech recognition	Networking
2	1	Which of the following is NOT a common application of computer vision?	C	1	Autonomous driving	Optical character recognition (OCR)	Speech-to-text conversion	Facial recognition
3	1	Which of the following is a fundamental challenge in computer vision?	B	1	Lack of storage	Interpretation of high-dimensional data	Low-quality networking	Text processing
4	1	In computer vision, "object detection" refers to:	C	1	Recognizing the identity of objects	Predicting future object locations	Locating objects within an image	Compressing the image
5	1	Which field closely relates to computer vision in understanding image content?	D	1	Signal processing	Natural language processing	Data mining	Robotics
6	1	What is one significant advantage of computer vision over human vision in terms of image analysis?	A	1	Computer vision can analyze a large number of images at a time without fatigue.	Human vision has a faster response time to image changes compared to computer vision.	Human vision is better at detecting patterns and extracting features in complex scenes.	Computer vision cannot recognize objects without pre-processed data, unlike human vision.
7	1	In grayscale images, the pixel intensity is typically represented by	A	1	8 bits	16 bits	24 bits	32 bits
8	1	A high-resolution image has	C	1	Fewer pixels	Larger pixel dimensions	More pixels per unit area	Lower file size
9	1	The coordinate system used to represent an image is usually	A	1	Cartesian	Polar	Cylindrical	Spherical
10	1	In the RGB color model, an image is represented using	C	1	One color channel	Two color channels	Three color channels	Four color channels
11	1	Which of the following describes a pixel in a binary image?	B	1	8-bit grayscale value	Single bit: 0 or 1	24-bit RGB value	Floating-point intensity
12	1	The process of capturing an image using a camera involves:	C	1	Pixel interpolation	Image segmentation	Light projection onto a sensor	Object tracking
13	1	In pinhole camera models, the focal length refers to:	C	1	Distance between lens and object	Distance between sensor and object	Distance between lens and sensor	Lens aperture size
14	1	Which of the following is NOT a key factor influencing image formation?	D	1	Light source	Object reflectance	Camera sensor	File compression
15	1	In the perspective projection model, objects further from the camera appear:	B	1	Larger	Smaller	Brighter	More distorted
16	1	The term "image plane" in the context of image formation refers to	B	1	The actual 3D object being captured	The 2D surface where the image is projected	The surface of the camera lens	The surface used for focusing light

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17	1	In a camera, the image captured is inverted due to	D	1	Image compression	Lens curvature	Perspective distortion	Light refraction through the lens
18	1	In image formation, "depth of field" refers to	B	1	The number of bits used per pixel	The distance range in focus	The speed at which an image is captured	The size of the image file
19	1	Which of the following terms describes how the brightness and color of objects change as they move further from the camera?	C	1	Parallax	Motion blur	Perspective distortion	Foreshortening
TOPIC NAME:- Camera Calibration(MCQS)								
20	1	A point in 3D space is given as P=(200,150,500). If the focal length of the camera is 50 mm, find the 2D coordinates of the point after projection on the image plane using homogeneous coordinates.	A	1	(20,15)	(20,25)	(10,15)	(20,5)
21	1	The process of estimating the internal and external parameters of a camera is called:	B	1	Image transformation	Camera calibration	Lens correction	Image compression
22	1	Intrinsic camera parameters describe properties such as:	C	1	Lens distortion	Camera's position and orientation	Camera's internal characteristics	Motion of objects
23	1	Which of the following is an example of an intrinsic camera parameter?	A	1	Focal length	Object distance	Camera position	Camera rotation
24	1	What does extrinsic camera calibration measure?	B	1	The camera's resolution	The relationship between camera coordinates and world coordinates	The amount of noise in an image	The level of lens distortion
25	1	The term "radial distortion" refers to:	C	1	Uneven color distribution in an image	Uneven color distribution in an image	Distortion of image lines due to lens curvature	Loss of sharpness at the image edges
26	1	Calibration patterns commonly used in camera calibration include:	C	1	Triangular grids	Circular grids	Checkerboard patterns	Random noise patterns
27	1	Which of the following is used to correct lens distortion in camera calibration?	C	1	Bilinear interpolation	Homography matrix	Distortion coefficients	Fourier transformation
28	1	Which of the following is NOT a step in camera calibration?	C	1	Capturing images of a calibration object	Estimating intrinsic parameters	Performing histogram equalization	Correcting lens distortion
29	1	Which of these tools is commonly used for camera calibration in computer vision libraries?	B	1	TensorFlow	OpenCV	Scikit-learn	PyTorch
30	1	Given the focal length of a camera (f = 50mm) and an object at a distance of 1000mm from the camera, calculate the size of the image formed if the object is 500mm in size.	D	1	22mm	15mm	20mm	25mm
31	1	In OpenCV, which function is used to estimate the intrinsic and extrinsic camera parameters?	C	1	cv2.estimateParameters()	cv2.findExtrinsics()	cv2.calibrateCamera()	cv2.estimateCameraParams()
32	1	Which OpenCV function converts an image from RGB to grayscale?	B	1	cv2.rgb2gray()	cv2.cvtColor()	cv2.convertToGray()	cv2.rgb2bw()
33	1	Given an image with a resolution of 1024x768 and pixel depth of 24 bits, calculate the size of the image in memory.	C	1	2 MB	4 MB	2.25 MB	25KB
34	1	Write a code for load and display image using openCV		3				

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35	1	An image I of size 800x600 pixels is resized to 400x300 pixels image J. Calculate the new resolution and how much the total number of pixels has been reduce. Find size of both images.		3				
36	1	What is the role of computer vision in industrial automation?		3				
37	1	Briefly describe the difference between image processing and computer vision.		3				
38	1	What is the difference between intrinsic and extrinsic camera parameters?		3				
39	1	Describe the pinhole camera model used in computer vision.		3				
40	1	If a camera has a focal length of 50mm and an object is located 2000mm away from the camera, what is the size of the object's image on the sensor, assuming the actual object is 500mm tall?		3				
41	1	Calculate the total number of pixels in an RGB image with a resolution of 1920×1080. How many bits are required to store this image assuming an 8-bit depth per channel?		3				
42	1	An image captured using a wide-angle lens shows barrel distortion. The camera's radial distortion coefficients are $k1$=0.01 and k2 =0.001. Given a point at coordinates (x = 300, y = 200) in the undistorted image, compute the corrected coordinates for this point .		3				
43	1	An image captured using a wide-angle lens shows barrel distortion. The camera's radial distortion coefficients are $k1$=0.03. Given a point at coordinates (x = 120, y = 20) in the undistorted image, compute the corrected coordinates for this point .		3				
44	1	How does camera calibration work, and how do intrinsic and extrinsic camera parameters differ?		3				
45	1	An image captured using a wide-angle lens shows barrel distortion. The camera's radial distortion coefficients are k1=0.02 and k2 =0.005. Given a point at coordinates (x = 55, y = 75) in the undistorted image, compute the corrected coordinates for this point.		2				
46	1	How does computer vision contribute to augmented reality (AR) applications?		3				
UNIT 2- DIGITAL IMAGE PROCESSING								
TOPIC NAME:Image Digitization, Image Manipulation and Color Space Conversions, Image Transformations								
47	2	In image digitization, which of the following steps involves converting continuous signals into discrete numerical values?	B	1	Sampling	Quantization	Interpolation	Aliasing

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48	2	What is the primary purpose of sampling in image digitization?	B	1	To reduce the number of bits required for image storage	To convert an analog image into a grid of pixels	To enhance the contrast of an image	To apply color transformations to an image
49	2	Which of the following is a typical bit depth for grayscale images?	B	1	4-bit	8-bit	16-bit	32-bit
50	2	In a typical RGB image, how many color channels are present?	C	1	1	2	3	4
51	2	If an image has a resolution of 1920x1080, how many pixels are there in total?	B	1	1,920,000	2,073,600	2,073	3,000,000
52	2	To display an image using OpenCV, which of the following functions is used?	B	1	cv2.display()	cv2.imshow()	cv2.show()	cv2.showimage()
53	2	What is the correct OpenCV function to rotate an image?	C	1	cv2.rotate()	cv2.rotateImage()	cv2.getRotationMatrix2D()	cv2.applyRotation()
54	2	In color space conversions, which of the following is a perceptually uniform color space?	D	1	RGB	CMYK	YUV	CIELAB
55	2	What is the main difference between RGB and HSV color models?	A	1	HSV separates intensity from color information, while RGB does not	RGB is used for image compression, while HSV is not	HSV uses more memory than RGB	RGB is device-independent, while HSV is not
56	2	In color space conversion, converting an image from RGB to grayscale is equivalent to reducing the number of:	A	1	Channels	Pixels	Colors	Dimensions
57	2	Which color space is commonly used for luminance-chrominance separation in video processing?	C	1	HSV	CMYK	YUV	LAB
58	2	What is the main purpose of performing affine transformations on an image?	B	1	To change the color space of the image	To rotate, scale, translate, or shear the image	To blur the image	To reduce the resolution of the image
59	2	When performing an image rotation by 90 degrees counterclockwise, how does the size of the image change?	C	1	It is doubled	It stays the same	The height and width are swapped	It is reduced by half
60	2	Which transformation preserves both distances and angles in an image?	B	1	Affine transformation	Euclidean transformation	Projective transformation	Nonlinear transformation
61	2	A perspective transformation is used to model:	D	1	Rotation and scaling	Translation and reflection	2D-to-3D transformations	Viewpoint changes in a 3D scene
62	2	Why is it important to perform quantization after sampling in image digitization?	B	1	To reduce the number of pixels	To limit the range of intensity values for each pixel	To enhance image resolution	To increase the number of bits per pixel
63	2	When converting from RGB to grayscale, why is a weighted average used for each pixel's R, G, and B values?	A	1	To maintain the intensity of colors as perceived by the human eye.	Because red and blue are naturally dimmer than green	To balance the contribution of each color channel	To minimize the size of the resulting image
64	2	In color space conversion, why is the HSV model useful for image manipulation tasks like color filtering?	B	1	It separates luminance from chrominance	It allows for easier manipulation of saturation and hue	It reduces the amount of memory needed for color images	It compresses image data for transmission
65	2	If an image undergoes a scaling transformation where the scale factor is greater than 1, what effect does this have on the image?	B	1	The image is reduced in size	The image is enlarged	The image's brightness is increased	The image's color space is converted
66	2	Why is affine transformation preferred in certain image manipulation tasks like object detection?	A	1	It allows for changes in object orientation and scale without distortion	It eliminates image noise and enhances features	It applies color correction automatically	It always results in square-shaped objects

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67	2	If an image has a resolution of 1024x768 pixels and each pixel is represented by 24 bits , how much memory is required to store the image (ignoring compression)?	B	1	1.5 MB	2.25 MB	4.5 MB	8 MB
68	2	An image with 256x256 resolution is reduced in size by a factor of 4. What is the resolution of the resulting image?	B	1	128x128	64x64	32x32	16x16
69	2	Given a grayscale image of 512x512 pixels, if each pixel is represented by 8 bits, how many bytes of memory are needed to store the image?	B	1	131,072 bytes	262,144 bytes	524,288 bytes	1,048,576 bytes
70	2	After performing a 90-degree clockwise rotation on a 1280x720 image, what will be the dimensions of the rotated image?	A	1	720x1280	1280x720	640x360	1440x810
71	2	If you scale an image by 50%, and the original image has 1000x1000 pixels, what is the resolution of the scaled image?	B	1	2000x2000	500x500	1000x500	750x750
72	2	How many distinct colors can be represented by a 24-bit RGB color image?	A	1	16,777,216	65,536	256	10,000,000
73	2	In image digitization, if the sampling rate is too low compared to the image's frequency content, which of the following phenomena will occur?	B	1	Overfitting	Aliasing	Noise	Quantization error
74	2	A 3x3 filter is applied to an image for edge enhancement. Calculate the output pixel value for the highlighted pixel of the following region of the image:	C	1	262,144	524,288	1,048,576	2,097,152
75	2	If the color depth of an image is 16 bits per pixel, how many grayscale shades can it represent?	D	1	16	256	1024	65,536
76	2	What is the result of applying an affine transformation matrix to a 2D point (x, y) if the matrix represents a scaling factor of 2?	B	1	(x, y)	(2x, 2y)	(x/2, y/2)	(y, x)
77	2	Given the focal length of a camera (f = 50mm) and an object at a distance of 1000mm from the camera, calculate the size of the image formed(in cm)if the object is 500mm in size.	C	1	1	2.7	2.25	2
78	2	What is image digitization, and what are the two main processes involved in it?		2				
79	2	What is image manipulation, and give two common types of image manipulations performed in computer vision.		2				
80	2	If given an image of dimensions 500x300 pixels. Calculate total number of pixels. If bit depth is 8bit,how many different shades possible. Calculate the new dimensions if: The image is resized by a factor of 0.5. The image is cropped to a region starting at (50, 50) and ending at (200, 200).		2				

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81	2	Given an image with dimensions 400x300 pixels. Write code to perform the following transformations: Translate the image 50 pixels to the right and 30 pixels down. Rotate the image by 45 degrees around the center.		2				
82	2	Convert the following RGB pixel (R = 50, G = 100, B = 150) to the HSV color space.		2				
83	2	Convert an image from RGB color space to HSV and calculate the value of the hue (H) for the RGB color (255, 0, 0).		2				
84	2	Write a program to downscale an image by a factor of 2 (both width and height) and display both the original and downscaled images using OpenCV.		3				
85	2	Write a program to convert a colored image (BGR) to grayscale and HSV color spaces using OpenCV, and display the result.		3				
86	2	Write a program to perform a perspective transformation on an image using OpenCV. Given four points in the input image, transform it to a new perspective.		3				
87	2	Write a program to apply an affine transformation to an image (translation, rotation, and scaling).		3				
UNIT 3- IMAGE ENHANCEMENT AND MORPHOLOGICAL OPERATIONS								
TOPIC NAME: Contrast and Brightness Adjustments , Image Smoothing, Noise Removal, Morphological Operations								
88	3	What is the purpose of histogram equalization in contrast adjustment?	C	1	To normalize pixel intensity values	To increase the brightness of an image	To spread out the most frequent intensity values	To sharpen the edges of an image
89	3	Which of the following is true about histogram equalization?	B	1	It always increases the brightness of the image	It enhances contrast by distributing pixel intensities uniformly	It reduces the amount of noise in the image	It applies a non-linear transformation to the pixel values
90	3	In Gaussian blur, what does the kernel size determine?	B	1	The amount of contrast in the image	The strength of the blur	The type of noise being removed	The edge detection in the image
91	3	How does a Median filter differ from a Gaussian filter in image smoothing?	A	1	Median filter preserves edges better than Gaussian filter	Median filter blurs the image more than Gaussian filter	Median filter reduces brightness, while Gaussian filter increases it	Median filter is faster than Gaussian filter
92	3	What is the key benefit of using bilateral filters for noise removal?	B	1	It sharpens the edges of the image	It smoothens the image without blurring edges	It increases the contrast of the image	It uniformly blurs all parts of the image
93	3	Which operation is used to enhance the boundaries of objects in morphological image processing?	B	1	Erosion	Dilation	Opening	Closing
94	3	In morphological operations, what does erosion do to an image?	B	1	Expands the bright regions of the image	Removes noise by shrinking bright areas	Increases the contrast of the image	Smooths out the edges of the objects
95	3	What is the purpose of applying a Gaussian blur before edge detection?	B	1	To increase the contrast of the image	To reduce high-frequency noise that might interfere with edge detection	To sharpen the edges of the image	To binarize the image for better edge extraction

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96	3	Which morphological operation is used to remove small noise points from a binary image while preserving the shape of larger objects?	C	1	Dilation	Erosion	Opening	Closing
97	3	Bilateral filters are particularly useful in which of the following situations?	B	1	Removing Gaussian noise from an image	Smoothing textures while preserving edges	Increasing image brightness	Adjusting the contrast of the image
98	3	What type of filter is most suitable for reducing salt-and-pepper noise in an image?	B	1	Gaussian blur	Median filter	Bilateral filter	Sobel filter
99	3	In morphological image processing, which operation is the combination of dilation followed by erosion?	B	1	Opening	Closing	Top-hat transformation	Hit-or-miss transformation
100	3	When using histogram equalization, what will happen if the image is already well-contrasted?	D	1	The image will remain unchanged	The image will become too bright	The image contrast will be enhanced further	The image may suffer from excessive contrast
101	3	What is the effect of increasing the sigma (standard deviation) in a Gaussian blur?	B	1	The blur effect becomes weaker	The blur effect becomes stronger and more spread out	The image becomes more contrasted	The noise in the image is enhanced
102	3	Why is bilateral filtering slower compared to Gaussian and Median filtering?	A	1	Because it processes each pixel based on both spatial and intensity information	Because it requires larger kernel sizes	Because it applies multiple filters simultaneously	Because it involves complex edge-detection algorithms
103	3	In histogram equalization, if an image has 256 levels of gray, how many possible values can the cumulative distribution function (CDF) take?	C	1	128	255	256	512
104	3	If a 5x5 Gaussian filter with a sigma of 1 is applied to a 100x100 image, how many total operations are needed for the convolution?	C	1	25	10,000	250,000	625,000
105	3	If a Median filter is applied to a 7x7 neighborhood, how many pixel values will be sorted to find the median?	D	1	7	14	28	49
106	3	In a morphological dilation operation using a 3x3 structuring element, how many pixels are affected for each pixel in a binary image?	D	1	1	3	5	9
107	3	If a Gaussian blur is applied with a kernel size of 5x5 and a sigma value of 1.5, how many pixels in total are considered for each operation in the convolution process?	A	1	25	15	9	5
108	3	After applying histogram equalization to a grayscale image with a range of pixel values from 0 to 255, what is the total range of pixel values in the output image?	B	1	0 to 128	0 to 255	10 to 245	50 to 200
109	3	If the probability distribution function (PDF) of an image is flat, what is the expected change in pixel distribution after histogram equalization?	A	1	The distribution will remain flat	The distribution will become non-uniform	The distribution will become concentrated around the mean	The distribution will become logarithmic
110	3	In a bilateral filter, if the spatial sigma is set too high, what is the likely result?	A	1	More blurring with less edge preservation	No effect on the image	Better noise removal and strong edge enhancement	Sharper contrast at the edges
111	3	If an image with dimensions 200x200 undergoes histogram equalization, how many values must be recalculated during the process?	B	1	200	40000	400000	256
112	3	In morphological opening using a 3x3 structuring element, how many pixels are considered for each pixel during the erosion process?	B	1	1	9	3	5

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113	3	A 7x7 Gaussian filter with a standard deviation of 2.0 is applied to an image. How many pixel values are included in each filter application?	B	1	25	49	35	14
114	3	In a Median filter applied to an 11x11 neighborhood, how many comparisons are needed to find the median?	C	1	10	50	121	89
115	3	For a Gaussian filter with kernel size 9x9 and sigma 1.5, what is the total number of pixels processed in the neighborhood of each pixel?	C	1	9	49	81	100
116	3	After performing a morphological dilation on a 100x100 binary image using a 5x5 structuring element, how many pixels in total are affected?	C	1	100	2500	10,000	25,000
117	3	A 3x3 Median filter is applied to a 512x512 image. How many pixels will be involved in the entire filtering process?	C	1	512	1,024	2,359,296	262,144
118	3	What is the key difference between Gaussian and Median filters in image processing?	B	1	Gaussian filter is non-linear, while Median filter is linear	Median filter preserves edges better than Gaussian filter	Median filter introduces more noise compared to Gaussian filter	Gaussian filter operates faster than Median filter
119	3	When performing histogram equalization on a color image, how are the pixel values treated?	A	1	Each color channel is processed independently	The image is converted to grayscale first	Only the red channel is equalized	The image is converted to binary format
120	3	Bilateral filtering is particularly useful for removing which type of noise?	A	1	Gaussian noise	Salt-and-pepper noise	Uniform noise	Speckle noise
121	3	Which morphological operation is used to fill gaps in an image?	D	1	Erosion	Dilation	Opening	Closing
122	3	In histogram equalization, what happens to pixel intensity values that occur less frequently?	C	1	They become even less frequent	They are grouped together	They are spread out across a wider range	They disappear from the image
123	3	In histogram equalization, if an image contains only two distinct gray levels, what will be the effect of applying histogram equalization?	C	1	The contrast will be enhanced dramatically	The output will be a uniformly distributed grayscale image	The two gray levels will remain unchanged	The image will be converted to a binary image
124	3	If a Gaussian filter is applied to an image with increasing kernel size but a fixed sigma, what will be the primary visual effect?	C	1	The edges will become sharper	The image will become noisier	The smoothing effect will increase, and fine details will blur	The image will lose all pixel intensity variation
125	3	In median filtering, if all pixels in the neighborhood are of equal value, what will the result of the filtering operation be?	C	1	The median will be different from the original values	The image will be smoothed even more	The median filter will preserve the original value	The image will become sharper
126	3	When performing Gaussian smoothing on an image with a very high noise level, what unexpected effect might occur when using a very small sigma value?	B	1	The noise will be exaggerated	The image will retain noise along with blurred edges	The noise will disappear completely	The image will get sharper with increased contrast

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127	3	Which of the following will most likely occur when applying a large structuring element for dilation on a noisy image?	B	1	Noise will be suppressed, and edges will become sharper	Small objects and noise will become more pronounced	The contrast will increase	The image will become binarized
128	3	What is the effect of performing opening followed by closing on an image (morphological operations) compared to applying either operation alone?	A	1	The image will have less noise and preserved shapes	Only large objects will remain, while small details will be removed	The image will become sharper	The operation will result in more noise being introduced
129	3	When performing histogram equalization on a dark image, what could happen to the image if a large number of pixels are concentrated in a narrow range of intensity values?	B	1	The dark regions will remain unchanged	The image will appear overly bright and noisy	The image will become too dark	The contrast will be perfectly balanced across all regions
130	3	In morphological image processing, when using a structuring element larger than the objects in the image for erosion, what is the expected result?	B	1	Objects will become more prominent	The objects will be completely removed	The objects will shrink but maintain their shape	The image will become noisier
131	3	If an image of size 512x512 is smoothed using a 5x5 Gaussian kernel, how many total multiplications are performed for the entire image during the convolution process?	C	1	512	2621440	6553600	131072
132	3	If a Bilateral Filter uses a 5×5 kernel, how many intensity comparisons are performed for each pixel?	C	1	5	1	25	289
133	3	After applying histogram equalization to an 8-bit grayscale image of size 300x300, what is the maximum possible number of distinct gray levels in the output image?	C	1	150	255	256	300
134	3	A 3x3 Median filter is applied to a noisy image with dimensions 1024x1024. How many total sorting operations are performed during the filtering process?	B	1	1024	9437184	10485760	1048576
135	3	A binary image undergoes morphological closing using a 5x5 structuring element on an image of size 512x512. How many pixels are affected during the dilation step alone?	D	1	655	1024	262144	6553600
136	3	When applying a Gaussian blur with a kernel size of 9x9 and a sigma of 2.0 to a 128x128 image, how many individual operations are required to process the entire image?	C	1	589,824	524,288	1,327,104	2,359,296
137	3	A 3X3Median filter is applied to a 16X16 image. How many pixel comparisons will be made across the entire image for filtering?	D	1	1024	64,536	7,938	2,304
138	3	Discuss the impact of different types of noise on images and how noise removal techniques work.		3				
139	3	How do contrast stretching and histogram equalization improve image quality		3				

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140	3	What are morphological operations in image processing?		3				
141	3	Given an image with pixel values ranging from 0 to 255, increase its brightness by adding 50 to each pixel value. What will be the new pixel values of pixels with initial values given in below image? 106 184 255 141 230 101 12 237 149 82 255 255 17 67 13 47 245 22 169 227 255 24 0 59 220		3				
142	3	Given an image region affected by salt-and-pepper noise, use a 3x3 median filter to smooth the image. If the center pixel value is 120 and its surrounding pixel values are {100, 110, 130, 140, 200, 80, 90, 70}, calculate the new center pixel value.		3				
143	3	Apply contrast stretching to an image where the pixel values range from 50 to 200, mapping them to a new range of 0 to 255. What would be the new pixel values for pixels with initial values of 50, 125, and 200?		5				
144	3	A Gaussian filter with a standard deviation of 1.35 is applied to an image. If the filter kernel size is 3x3, calculate the weights of the kernel.		5				
145	3	A Gaussian filter with a standard deviation of 1.5 is applied to an image. If the filter kernel size is 3x3, calculate the weights of the kernel.		5				
146	3	Given an image affected by salt-and-pepper noise, use a 3x3 median filter to smooth the image. If the center pixel value is 120 and its surrounding pixel values are {100, 110, 130, 140, 200, 80, 90, 70}, calculate the new center pixel value.		5				
147	3	Calculate the result of applying dilation to a binary image with a 3x3 structuring element. The input 5x5 binary matrix is: 0 1 1 1 1 1 1 1 0 1 1 0 0 0 0 1 Structuring Element (kernel): [1 1 1 1] Note:Place and replace top left element of image		5				

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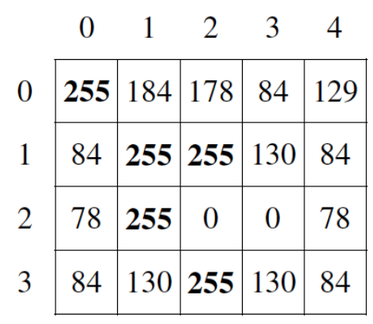
Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
148	3	Calculate the result of applying erosion to a binary image with a 3x3 structuring element. The input 5x5 binary matrix is: 0 1 1 0 1 1 1 1 0 0 1 0 0 0 1 1 Structuring Element (kernel): [1 0 1 1] Note:Place and replace top left element of image		5				
149	3	For an image with a pixel intensity range of 0 to 255, apply histogram equalization and find the new pixel value for an intensity of 100 if the cumulative distribution function (CDF) value for that intensity is 0.4.		5				
150	3	A 3x3 Laplacian filter is applied to an image for edge enhancement. Calculate the output pixel value for BOLD pixels only of the following region of the image: 		5				

	0	1	2	3	4
0	**255**	184	178	84	129
1	84	**255**	**255**	130	84
2	78	**255**	0	0	78
3	84	130	**255**	130	84

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
151	3	A 3x3 filter is applied to an image for edge enhancement. Calculate the output pixel value for the highlighted pixel of the following region of the image: (on highlighted pixels only) 100 105 110 95 100 105 90 95 100 Filter is: 0 -1 0 -1 4 -1 0 -1 0		3				
152	3	Histogram Equalization with 5 Intensity Levels: A grayscale image with 5 intensity levels and the following pixel distribution: Intensity Level Frequency (Number of Pixels) 0. 50 1. 30 2. 80 3 40 4 100		5				
153	3	Plot histogram of following image.Perform Histogram equalization of same image.(intensity levels 0 to 8) 0 5 7 7 5 8 7 8 7 2 6 2 6 5 6 8 6 9 7 7 0 7 2 7 6 6 1 7 6 7 7 5 9 6 0 7 8 2 6 7 2 8 8 2 7 6 7 8 7 3 2 6 1 7 5 8 9 9 5 6 7 7 7 7		5				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
154	3	For the following 5*5 image, perform histogram equalization. Show the histogram before and after equalization. 4 4 4 4 4 3 4 5 4 3 3 5 5 5 3 3 4 5 4 3 4 4 4 4 4		5				
155	3	Perform Histogram Equalization with following image: 1 0 2 2 6 2 1 3 2 1 3 6 0 7 4 7 1 1 0 5 2 7 1 2 1		3				
UNIT 4-IMAGE FILTERING AND EDGE DETECTION								
TOPIC NAME: Spatial Domain Filtering, Frequency Domain Transformation and Filtering , Edge Detection Techniques								
152	4	Which of the following edge detection techniques involves both first and second derivatives?	B	1	Sobel	Laplacian of Gaussian (LoG)	Prewitt	Roberts
153	4	Why is the non-maximum suppression step crucial in the Canny edge detection algorithm?	C	1	It reduces the noise in the image	It removes spurious edges caused by noise	It sharpens the edges by retaining only the strongest gradients	It converts the edges to binary
150	4	Which edge detection technique is least effective in detecting edges?	C	1	Sobel	Prewitt	Roberts	Canny
151	4	What is the gradient in the x-direction using the Sobel kernel for the center pixel? [10 10 20 20 30 40 10 10 20]	B	1	40	60	100	120
152	4	If the gradient magnitude in the x-direction is 80, and in the y-direction it is 60, what is the total gradient magnitude at that pixel?	A	1	100	140	180	200
153	4	In edge detection, which operator is most likely to detect noise as edges due to its sensitivity to pixel intensity changes?	C	1	Canny	Sobel	Roberts	Laplacian

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
154	4	What is the role of Gaussian blurring before edge detection using the Canny algorithm?	C	1	To enhance edges	To reduce image size	To remove noise	To sharpen the image
155	4	Which edge detection method uses two thresholds to classify pixels as strong or weak edges?	C	1	Sobel	Laplacian	Canny	Prewitt
156	4	A 3x3 Prewitt filter is applied to a 3x3 image region, and the gradients in the x-direction and y-direction are 50 and 40, respectively. What is the resultant edge strength at the center pixel?	B	1	60	64.03	80	100
157	4	What is the major disadvantage of the Roberts edge detector compared to the Sobel operator?	C	1	High computation time	Inability to detect diagonal edges	Increased sensitivity to noise	Detects fewer edges
158	4	Which of the following operators can detect edges in all directions (horizontal, vertical, diagonal)?	B	1	Roberts	Laplacian	Sobel	Prewitt
159	4	After applying a 3x3 Sobel filter in the x-direction, the following gradients are calculated: 120, 100, and 80. What is the average gradient in the x-direction?	B	1	80	100	110	120
160	4	Which of the following is a limitation of the Sobel operator?	A	1	Not good at handling noisy images	Detects too many edges	Only detects horizontal edges	Computationally expensive
161	4	The term "zero crossing" in edge detection is associated with which operator?	C	1	Sobel	Prewitt	Laplacian of Gaussian	Roberts
162	4	Which edge detection technique applies Gaussian smoothing before calculating gradients?	D	1	Prewitt	Roberts	Laplacian	Canny
163	4	What is the result of applying a Prewitt operator in the x-direction to the following image patch? [0 100 100 0 100 100 0 100 100]	B	1	200	300	400	500
164	4	What is the primary difference between the Sobel and Prewitt operators?	B	1	Kernel size	Smoothing component in Sobel	Prewitt uses Gaussian smoothing	Sobel is computationally less expensive
165	4	Calculate the magnitude of the gradient at a pixel where Gx=6 and Gy=8	A	1	10	12	14	15
166	4	The Laplacian operator detects edges based on	B	1	First derivative	Second derivative	Image intensity values	Image histogram
167	4	Which type of filter is commonly used to reduce noise while preserving edges?	B	1	Gaussian filter	Median filter	Average filter	High-pass filter
168	4	If a 3x3 average filter is applied to the following image region, what will be the new intensity value of the center pixel? [100 110 120 90 100 110 80 90 100]	B	1	90	100	110	105
169	4	Which of the following filters is most effective for reducing salt-and-pepper noise?	C	1	Gaussian filter	Average filter	Median filter	Sobel filter
170	4	After applying a 5x5 Gaussian filter with a standard deviation of 1.0, the sum of the filter weights is:	A	1	1	2	0	5

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
171	4	What is the effect of applying a high-pass filter to an image?	C	1	Reducing noise	Smoothing the image	Enhancing edges	Blurring the image
172	4	Which of the following filters is designed to smooth images while maintaining edges?	D	1	Average filter	High-pass filter	Median filter	Bilateral filter
173	4	If a 3x3 average filter is applied to the following image region, what will be the new intensity value of the center pixel? [50 100 150 100 150 200 150 200 250]	A	1	150	100	200	180
174	4	Which filtering technique is most suitable for edge detection?	C	1	Low-pass filter	Gaussian filter	High-pass filter	Median filter
175	4	The center pixel intensity value in a 3x3 Gaussian filter after filtering is 80. The sum of surrounding pixels is 640. What is the original pixel intensity value if the filter doesn't change the total intensity?	A	1	80	100	120	60
176	4	Explain the difference between spatial domain filtering and frequency domain filtering.		2				
177	4	Why are Fourier transforms important in frequency domain filtering?		2				
178	4	What is the role of the Gaussian filter in image processing		2				
179	4	State the process of canny edge detection technique. Write its OpenCV code to detect edge from given image.		2				
180	4	Explain the concept of frequency domain filtering with an example of a high-pass filter.		2				
181	4	What is the significance of the Fast Fourier Transform (FFT) in frequency domain filtering?		2				
182	4	Increase the brightness of an image by adding 30 to each pixel value. If the pixel values are 120, 130, and 140, what are the new values?		3				
183	4	Apply a low-pass filter in the frequency domain to block frequencies higher than 30 Hz. Given a 512x512 image with maximum frequency of 50 Hz, calculate the cutoff frequency ratio.		3				
184	4	Given a 2D image represented as: [1 2 3 4] Calculate the 2D Discrete Fourier Transform (DFT) for the given image.		3				
185	4	Apply the Sobel operator on the following 3x3 matrix in the x-direction: [100 150 200 100 150 200 100 150 200]		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
186	4	Apply a 3x3 Gaussian filter with the following kernel to an image patch: [1 2 1 2 4 2 1 2 1] to the image region: [10 20 30 40 50 60 70 80 90] Normalize the kernel by dividing by 16.		3				
187	4	Given a 256x256 image with a maximum frequency of 128 Hz, a high-pass filter is applied to block frequencies lower than 50 Hz. Calculate the fraction of the frequency components that remain in percentage.		3				
188	4	An image has a size of 512x512. Using FFT for frequency domain filtering, calculate the number of operations required for the transformation, assuming NlogN complexity, where N=512×512.		3				
189	4	Apply unsharp masking to an image with a Gaussian smoothed version having pixel values of 120, 130, and 140. The original pixel values are 150, 160, and 170. Use a sharpening factor of 1.5. Calculate the sharpened pixel values.		3				
190	4	Given a 3x3 window in a salt-and-pepper noise-affected image with pixel values: [255 0 255 0 50 0 255 0 255] Apply a median filter to this window. What is the new value of the center pixel?		3				
191	4	Apply the Laplacian filter on the following 3x3 matrix in the x-direction: [100 150 200 100 150 200 100 150 200] Laplacian Kernel: 0 -1 0 -1 4 -1 0 -1 0		3				
192	4	Given a Canny edge detection algorithm with lower and upper thresholds set at 100 and 200 respectively, determine if a gradient magnitude of 150 will be considered an edge.		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
193	4	Given a 3x3 window in a salt-and-pepper noise-affected image with pixel values: [100 0 25 0 20 0 29 0 55] Apply a median filter to this window. What is the new value of the center pixel?		3				
194	4	Given a 2D image represented as: [5 2 3 8] Calculate the 2D Discrete Fourier Transform (DFT) for the given image.		3				
195	4	Given a 2D image represented as: [11 12 13 18] Calculate the 2D Discrete Fourier Transform (DFT) for the given image.		3				
196	4	If a 3x3 average filter is applied to the following image region, what will be the new intensity value of the four corner pixel? [120 110 150 90 100 150 80 100 100]		5				
197	4	Given a 512x512 image with a maximum frequency of 100 Hz, a high-pass filter is applied to block frequencies lower than 50 Hz. Calculate the fraction of the frequency components that remains in percentage.		5				
UNIT 5- FEATURE DETECTION AND DESCRIPTORS								
TOPIC NAME:Corner and Blob Detection, Feature Descriptors								
198	5	Which of the following is the main characteristic of a corner point?	C	1	It is where the intensity gradient is constant in all directions.	It is where the intensity gradient is zero in all directions.	It is where the intensity gradient has significant changes in multiple directions.	It is a point where the image is completely flat.
199	5	In Harris Corner Detection, which matrix is used to compute the corner response?	B	1	Covariance matrix	Structure tensor (M)	Rotation matrix	Projection matrix
200	5	Harris Corner Detector is rotation invariant because:	D	1	It uses eigenvalues of the structure tensor.	It normalizes the image gradient.	It uses Fourier transform.	Corners remain corners under rotation.
201	5	In SIFT, what is the main purpose of the Difference of Gaussians (DoG)?	B	1	To blur the image	To detect scale-space extrema	To normalize image intensity	To detect corner points
202	5	The Harris Corner Detector is sensitive to which of the following?	B	1	Rotation	Noise	Scaling	Affine transformations
203	5	Which key step in SIFT involves the localization of keypoints using a 3D quadratic function?	B	1	Orientation assignment	Keypoint localization	Scale-space extrema detection	Keypoint matching

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
204	5	Which feature descriptor is specifically designed to handle changes in illumination and contrast?	B	1	Harris Corner	SIFT	HOG	FAST
205	5	What is the key function of the HOG descriptor?	C	1	To detect edges based on Sobel filters	To detect blobs in an image	To describe image patches based on gradient orientations	To describe textures based on pixel intensity
206	5	In Harris Corner Detection, the corner response function R is computed as:	B	1	R = det(M) + k × trace(M)	R = det(M) - k × trace(M)²	R = det(M) / trace(M)	R = k × (det(M) × trace(M))
207	5	In SIFT, what does each keypoint descriptor consist of?	A	1	A 128-dimensional vector	A 32-dimensional vector	A 64-dimensional vector	A 256-dimensional vector
208	5	Which of the following is NOT a step in the SIFT algorithm?	D	1	Feature descriptor computation	Keypoint matching	Scale-space extrema detection	Blob detection
209	5	What does the constant 'k' in the Harris Corner formula represent?	D	1	Sensitivity to noise	Corner sharpness	Threshold for corner response	Empirical constant for corner sensitivity
210	5	Which technique is best suited for object detection in images with dense texture?	B	1	Harris Corner Detector	HOG	SIFT	FAST
211	5	In the Harris Corner Detector, what condition defines a corner?	B	1	The eigenvalues of M are	The eigenvalues of M are	The eigenvalues of M are	The eigenvalues of M are
212	5	In Harris Corner Detection, if the eigenvalues λ_1 and λ_2 are 100 and 150 respectively, with k = 0.04, what is the corner response R?	C	1	8000	10000	12500	9000
213	5	Given a HOG descriptor with a block size of 2x2 cells and a cell size of 8x8 pixels, how many gradient bins are typically used per cell?	B	1	6	9	12	16
214	5	In SIFT, if a keypoint is detected at scale $\sigma_1 = 1$, what would the corresponding DoG pyramid level be for scale σ_1 multiplied by 2?	A	1	2	3	4	5
215	5	In HOG, if you have 8 cells with 9 orientation bins each, how many features are generated from this block?	A	1	72	64	81	144
216	5	What is the determinant of the matrix M if the eigenvalues are 50 and 75?	B	1	1250	3750	6250	2500
217	5	In Harris Corner Detection, if R is negative, what does this indicate?	B	1	Flat region	Edge	Corner	No feature
218	5	What is the trace of the matrix M if the eigenvalues are 30 and 70?	C	1	30	50	100	40
219	5	For a 128-dimensional SIFT feature vector, how many key points can be stored in an image if 10,000 bytes are allocated?	B	1	78	19	50	62
220	5	In HOG, what is the contribution of each pixel to the gradient orientation?	A	1	Gradient magnitude	Pixel intensity	Corner strength	Block size
221	5	How many octaves are typically used in SIFT to detect keypoints across scales?	C	1	4	3	5	6
222	5	Which OpenCV function is used to detect corners using the Harris Corner Detector?	A	1	cv2.cornerHarris()	cv2.detectCorners()	cv2.cornerDetect()	cv2.cornerMinEigenVal()
223	5	In OpenCV, which function is used to compute SIFT descriptors?	C	1	cv2.SIFT_compute()	cv2.SIFT_descriptor()	cv2.SIFT.detectAndCompute()	cv2.SIFT.detectDescriptor()
224	5	What does the cv2.HOGDescriptor() function do in OpenCV?	B	1	Detects keypoints	Computes histogram of gradients	Detects corners	Applies edge detection
225	5	What is the input to the cv2.cornerHarris() function?	A	1	Grayscale image	Binary image	Color image	Edge-detected image

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
226	5	What parameter is critical for tuning in the cv2.cornerHarris() function to control the sensitivity to corners?	C	1	Block size	Sobel kernel size	Harris detector free parameter k	Threshold value
227	5	Given a structure tensor matrix M with eigenvalues 80 and 120, and k = 0.05, compute the corner response R using the Harris corner formula		2				
228	5	If a Harris Corner Detector detects 150 corners in a 256x256 image, what is the average number of corners detected per pixel?		2				
229	5	In HOG, if you have a block size of 2x2 cells and each cell has 9 orientation bins, how many features are generated per block?		2				
230	5	For a Harris Corner Detector, if R=−50, what type of feature is detected, and why does the value of *R* matter?		2				
231	5	Describe the steps involved in the SIFT algorithm, from keypoint detection to descriptor matching.		2				
232	5	How does the Difference of Gaussians (DoG) help in detecting scale-space extrema in SIFT?		3				
233	5	Compare and contrast Harris Corner Detector and SIFT in terms of feature detection capabilities.		3				
234	5	What is the significance of the gradient orientation histogram in HOG, and how does it contribute to object detection?		3				
235	5	How do scale and rotation invariance in SIFT contribute to its effectiveness in detecting features across different images?		3				
236	5	What is the role of the empirical constant k in Harris Corner Detection, and how does it affect corner detection?		3				
237	5	Describe the process of keypoint matching using the SIFT algorithm and explain the use of distance ratios.		3				
238	5	State the process of canny edge detection technique.Write opencv code to Prewitt edge detect from given image.		3				
239	5	In Harris Corner Detection, if the structure tensor matrix has the values A=200, B=50, and C=100, compute the corner strength using the Harris response equation.		3				
240	5	Calculate the HOG descriptor length for a detection window of 128x64 pixels, with 8x8 pixel cells and 9 orientation bins.		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
241	5	Given the following descriptors from two images, use FLANN to find the nearest neighbor for each descriptor in D_A from D_B. Apply Lowe's ratio test with a threshold of 0.45 and indicate whether the match is valid. Descriptors for Image A (D_A): 0.1 0.5 0.3 0.4 0.2 0.8 0.6 0.7 0.9 Descriptors for Image B (D_B): 0.2 0.5 0.7 0.4 0.1 0.6 0.3 0.7 0.8 Euclidean Distance Formula:d= SQRT(∑(D _A [i]−D_B[j]) 2) Find the nearest and second nearest neighbor for each descriptor in D_A. Check the matches using Lowe's ratio test.		5				
242	5	Given the following 3×3 grayscale image matrix: *I*= [100 150 200 80 120 160 50 70 90] 1. Use the Sobel operator to calculate the gradients at the center pixel (1,1) of the image. 2. Calculate the gradient magnitude M and the gradient direction θ at the center pixel (1,1)		5				
243	5	Given the following 3x3 grayscale image: Image= 1 2 3 4 5 6 7 8 9 Perform Harris Corner Detection on the image. a. Apply the Sobel operator to compute the gradients for the pixel at position (1,1). b. Calculate the structure tensor M for pixel (1,1) using the gradients. c. Compute the Harris corner response R for pixel (1,1) using the formula: R=det(M)−k·(trace(M))^2 Where k=0.04. d. Classify the pixel at (1,1) as a corner, edge, or non-interest point based on the value of *R*.		4				
UNIT 6 IMAGE SEGMENTATION								
TOPIC NAME: Thresholding Techniques, Clustering for Segmentation, Region-based Segmentation, Watershed Algorithm								

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
244	6	Which of the following is a simple thresholding technique?	A	1	Otsu's method	K-means clustering	Watershed algorithm	Region growing
245	6	In adaptive thresholding, the threshold is calculated based on:	B	1	Global average intensity	Local region properties	Pixel gradient	Histogram equalization
246	6	What is the main disadvantage of global thresholding?	C	1	It's too fast	It requires too much memory	It doesn’t adapt to lighting variations	It works only for colored images
247	6	Otsu's method minimizes the intra-class variance by:	C	1	Maximizing the sum of pixel values	Minimizing inter-class variance	Separating foreground and background	Using k-means clustering
248	6	Which clustering algorithm is commonly used for image segmentation?	A	1	K-means	ISODATA	Agglomerative clustering	Hierarchical clustering
249	6	Which step is first in K-means clustering?	C	1	Recalculating cluster centers	Assigning pixels to the nearest cluster	Selecting initial cluster centers	Converting image to grayscale
250	6	Region-based segmentation is typically based on:	B	1	Intensity histograms	Homogeneity criteria	Discontinuity detection	Gradient edge detection
251	6	In the Watershed algorithm, what is typically used to mark initial regions for segmentation?	C	1	Random noise	Pixel intensity gradient	Distance transforms or markers	Morphological operations
252	6	Which of the following is not a region-based segmentation method?	C	1	Region growing	Region splitting and merging	Thresholding	Watershed algorithm
253	6	Watershed algorithm is best suited for:	D	1	Separating well-defined regions	Object recognition	Feature extraction	Detecting boundaries between overlapping objects
254	6	Clustering is an example of:	B	1	Supervised learning	Unsupervised learning	Reinforcement learning	Semi-supervised learning
255	6	Which distance metric is commonly used in K-means clustering?	C	1	Manhattan distance	Hamming distance	Euclidean distance	Cosine similarity
256	6	Region growing segmentation starts with:	B	1	Edge detection	A seed pixel	Global thresholding	Feature extraction
257	6	Which of the following is a drawback of the Watershed algorithm?	C	1	It cannot detect edges	It is too slow	It often leads to over-segmentation	It doesn’t work for grayscale images
258	6	Otsu’s thresholding is typically used for:	B	1	Multi-class segmentation	Binary segmentation	Color image segmentation	Edge detection
259	6	What role do "markers" play in the Watershed algorithm?	A	1	Indicate where segmentation should start	Combine regions based on pixel intensity	Define edges in the image	Smooth the image
260	6	In region-based segmentation, what is a common criterion for merging two regions?	B	1	Gradient magnitude	Homogeneity in pixel values	Color differences	Texture variance
261	6	What is the primary difference between global and adaptive thresholding?	A	1	Global applies one threshold, adaptive applies multiple based on local regions	Adaptive is slower than global	Global requires supervised learning, adaptive does not	There is no difference
262	6	K-means clustering requires which of the following as input?	A	1	Number of clusters (k)	Edge detection algorithm	Ground truth labels	Marker positions
263	6	How does ISODATA clustering handle splitting and merging of clusters?		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
264	6	Explain how ISODATA clustering would process the following data points with initial clusters: Cluster 1: (2,10),(3,8),(1,9) Cluster 2: (10,2),(12,4),(9,3) Given: Splitting variance threshold = 5, merging distance threshold = 3.		3				
265	6	Write a Python program to implement the region splitting and meerging		3				
266	6	Write a Python program using OpenCV to apply global thresholding to an image.		3				
267	6	Implement K-means clustering in Python using OpenCV for image		3				
268	6	Write a Python code to implement Otsu's thresholding.		3				
269	6	Write a Python program to implement the Watershed algorithm in OpenCV.		3				
270	6	In a grayscale image, pixel intensities in two regions are: [50, 55, 60] and [100, 105, 110]. Compute the between-class variance using Otsu's method for a threshold of 80.		3				
271	6	An image contains regions with pixel intensities: [10, 10, 12, 200, 205, 210]. Use Otsu's method to calculate the inter-class variance for a threshold at 100.		3				
272	6	In a 3x3 image, the pixel intensities are as follows: [50 50 50 50 150 50 50 50 50} Calculate the distance transform of this image, which will be used in the Watershed algorithm.		3				
273	6	Given a grayscale image with the following pixel intensities: Pixel Values Frequency 0 5 50 8 100 12 150 10 200 6 255 9 Calculate the variance at threshold 100 using Otsu's method		3				
274	6	What is the difference between global and adaptive thresholding? How does adaptive thresholding work in varying lighting conditions across an image?		3				
275	6	Discuss the concept of clustering in image segmentation. How does K-means clustering work, and what role does it play in segmenting		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
276	6	Given a grayscale image with the following pixel intensities: Pixel Values Frequency 0 5 70 8 100 12 130 11 220 6 255 8 Calculate the variance at threshold 100 using Otsu's method		4				
277	6	Histogram: Intensity Frequency 30 5 60 10 90 15 120 20 180 10 240 5 Find the Otsu threshold that maximizes σb^2. Show calculations for thresholds at 90, 120, and 150.		4				
278	6	An image has the following gray levels and frequencies: Intensity Frequency 0 10 80 20 120 30 160 25 200 10 255 5 Calculate: Class probabilities ,Class means ,The between-class variance at threshold 120. Is threshold 120 likely to be optimal?		4				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
279	6	Pixel intensities and frequencies: Intensity Frequency 20 5 60 10 110 15 170 10 210 5 For K=2, with initial centroids C_1=20 and C_2=100, perform: Cluster assignment step. Compute new centroids. Show how cluster membership changes.		3				
280	6	Consider a grayscale image with the following pixel intensity values: Pixel Intensity Frequency 20 5 50 10 120 15 200 10 220 5 how to apply K-means clustering to segment the image into two clusters (K=2,C1=20, C2=120)		5				
281	6	Explain how ISODATA clustering would process the following data points with initial clusters: Cluster 1: (2,10),(3,8),(1,9) Cluster 2: (10,2),(12,4),(9,3) Given: Splitting variance threshold = 5, merging distance threshold = 3.		2				

UNIT 7 CONVOLUTION NEURAL NETWORK FOR IMAGE CLASSIFICATION

TOPIC NAME: Introduction to CNNs(Convolutional layers, pooling layers, fully connected layers), Image Classification ,Object Detection

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
282	7	What is the primary function of a convolutional layer in a CNN?	B	1	To reduce the dimensionality of the image	To detect features like edges, textures, and patterns	To fully connect the neurons in the network	To apply a nonlinear activation function
283	7	Which of the following is a key benefit of using pooling layers in CNNs?	B	1	Increasing the depth of the network	Reducing the number of parameters	Preventing overfitting by randomizing pixel values	Enhancing the accuracy of classification
284	7	In a convolutional layer with a 3x3 filter and a stride of 1, what is the output size if the input image is 64x64 with no padding?	C	1	63x63	64x64	62x62	32x32
285	7	What type of pooling layer is most commonly used in CNN architectures?	A	1	Max pooling	Average pooling	Mean pooling	Global pooling
286	7	If a convolutional layer has 64 filters, each of size 3x3, how many parameters does the layer have (excluding bias terms)?	A	1	576	512	2048	5760
287	7	How does a fully connected layer differ from a convolutional layer?	A	1	A fully connected layer connects all neurons from the previous layer, while a convolutional layer connects only local regions	A fully connected layer applies an activation function, while a convolutional layer does not	A fully connected layer reduces the image size, while a convolutional layer does not	A fully connected layer uses pooling, while a convolutional layer does not
288	7	In image classification, which CNN layer is responsible for making the final prediction?	C	1	Convolutional layer	Pooling layer	Fully connected layer	Activation layer
289	7	In object detection models like YOLO, what does the acronym YOLO stand for?	B	1	You Only Learn Once	You Only Look Once	You Optimize Layer Outputs	You Obtain Local Outputs
290	7	How does YOLO differ from traditional object detection techniques?	A	1	YOLO performs detection in a single forward pass through the network	YOLO applies convolution to individual image regions	YOLO uses a fully connected network for feature extraction	YOLO divides the image into non-overlapping regions and applies classification only
291	7	What is the purpose of anchor boxes in object detection models like SSD (Single Shot Multibox Detector)?	B	1	To classify each pixel as an object	To help predict multiple objects of different sizes and aspect ratios	To increase the resolution of detected objects	To apply max pooling to feature maps
292	7	In a YOLO-based object detection system, the final layer predicts multiple bounding boxes per grid cell. What is typically predicted for each bounding box?	A	1	Class probabilities, confidence score, and four coordinates (x, y, width, height)	Class probabilities and the object's centroid	Object's rotation angle and class probability	Depth of the object in the image

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
293	7	If a pretrained VGG16 model has 138 million parameters, how can the number of parameters be reduced when fine-tuning the model?	A	1	By freezing the weights of the convolutional layers and only training the fully connected layers	By adding more layers to the network	By reducing the size of the input image	By increasing the learning rate
294	7	Why is transfer learning particularly useful when training CNNs on small datasets?	B	1	It allows the network to learn from scratch	It uses the learned weights from large datasets to avoid overfitting on small datasets	It decreases the number of parameters in the model	It removes the need for data augmentation
295	7	If the CNN's filter size is too large, what problem might occur?	B	1	The network might overfit to the training data	The network may underfit, failing to capture fine-grained features	The network will have too many pooling layers	The network will automatically ignore irrelevant features
296	7	If a CNN uses a 5x5 filter with a stride of 2 and padding of 1, what will be the output size for an input image of size 32x32?	A	1	15x15	16x16	30x30	32x32
297	7	A CNN model uses 100 filters of size 3x3x64 in its first convolutional layer. How many parameters are there in this layer (including biases)?	B	1	1,600	57,700	115,200	172,800
298	7	If a CNN with a fully connected layer has 4096 input units and 10 output units, how many total weights does this layer have?	C	1	4096	409,600	40,960	41,960
299	7	A convolutional layer uses 64 filters of size 3x3 with a stride of 1 and no padding. If the input image size is 128x128, what is the output size?	B	1	64x64	126x126	128x128	63x63
300	7	In a YOLO-based object detection system, the final layer predicts multiple bounding boxes per grid cell. What is typically predicted for each bounding box?	B	1	Class name,confidence score, and x, y, width, height	Class probabilities,confidence score, and x, y, width, height	Class Labels and the object's centroid	Object's rotation angle and class probability
301	7	In YOLO object detection, if an image is divided into 13x13 grids and each grid cell predicts 5 bounding boxes, how many total bounding boxes are predicted?	A	1	845	260	8450	585

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
302	7	You are training a CNN with 1,000,000 parameters using the Adam optimizer with a learning rate of 0.001. After 100,000 iterations, what will the total number of updates made to the parameters be?	D	1	10,000	100,000	1,000,000	. 1,00,000,000,000
303	7	In a pretrained ResNet model, if the final output layer has 1000 units for classification, how many categories can the model classify images into?	C	1	100	500	1000	1024
304	7	Describe how a fully connected layer operates in a CNN and its role in image classification tasks.		3				
305	7	Write a Python code using TensorFlow/Keras to create a basic CNN architecture for image classification, including convolution, pooling, and fully connected layers.		3				
306	7	Given a 128x128 image and a convolution filter of size 3x3 with a stride of 1 and no padding, calculate the output feature map size.		3				
307	7	If you apply a max pooling layer with a filter size of 2x2 and stride 2 on a feature map of size 64x64, what will be the size of the output?		3				
308	7	Implement a convolution operation manually in Python for a 5x5 image with a 3x3 filter.		3				
309	7	Given the confusion matrix for a binary classification problem, calculate the accuracy, precision, and recall of the CNN model. Confusion Matrix: [80 10 20 90]		3				
310	7	If a YOLO model processes images at 30 frames per second with an input size of 416x416, how long would it take to process 3000 images?		3				
311	7	Explain the concept of anchor boxes in SSD and how they contribute to accurate object detection.		3				
312	7	Explain the YOLO (You Only Look Once) object detection algorithm and its key features.		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
313	7	Write a Python code to implement object detection using a pre-trained YOLO model.		5				
314	7	What are the limitations of YOLO and SSD when applied to real-time object detection?		5				
315	7	Discuss the challenges faced during the training of CNNs for image classification, such as overfitting and class imbalance.		5				
316	7	What techniques can be applied to improve the generalization of CNNs in image classification tasks		5				
317	7	What is a bounding box in YOLO? Write a Python code to implement object detection using a pre-trained YOLO model.		3				
UNIT 8 ADVANCED CNN TECHNIQUES								
TOPIC NAME: Transfer Learning, Attention Mechanisms in CNNs, Practical Applications of CNNs								
318	8	What is the primary advantage of transfer learning?	B	1	Reduces the size of the neural network	Speeds up training by using pre-trained models	Increases the dataset size	Reduces the need for backpropagation
319	8	In transfer learning, which layers of a CNN are usually fine-tuned?	C	1	Initial convolutional layers	Middle layers	Fully connected layers	All layers
320	8	Which of the following is a common pre-trained CNN model used for transfer learning?	A	1	VGG16	K-NN	Decision Tree	Naive Bayes
321	8	Which type of learning does transfer learning mainly focus on?	C	1	Unsupervised learning	Semi-supervised learning	Supervised learning	Reinforcement learning
322	8	Why is transfer learning useful in domains with limited labeled data?	B	1	It generates synthetic data	It requires fewer labeled data points by leveraging pre-trained knowledge	It increases data augmentation	It eliminates the need for a neural network
323	8	Which of the following is a common approach in transfer learning?	A	1	Feature extraction	Data normalization	Model pruning	Activation quantization
324	8	When applying transfer learning, which of the following tasks is typically avoided?	A	1	Training the entire model from scratch	Fine-tuning the classifier layer	Using a pre-trained model on a new task	Retraining the top layers on a small dataset
325	8	Which of the following metrics is most relevant for transfer learning performance evaluation?	C	1	Recall	Learning rate	Validation accuracy	Precision

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
326	8	In transfer learning, freezing layers refers to:	A	1	Disabling gradient updates for certain layers	Increasing the number of laye	Removing dropout layers	Increasing learning rate for certain layers
327	8	Which pre-trained model is commonly used in natural image classification for transfer learning?	A	1	ResNet	SVM	HOG	Gradient Boosting
328	8	What is the main function of attention mechanisms in neural networks?	B	1	Reducing the complexity of the model	Highlighting important parts of the input	Enhancing feature extraction layers	Reducing training time
329	8	Which of the following is a type of attention mechanism?	A	1	Global attention	Softmax attention	K-means attention	Singular attention
330	8	What is the purpose of the attention map in CNNs?	B	1	To visualize weights	To enhance learning by focusing on relevant features	To compute the gradient	To optimize convolution operations
331	8	Self-attention in CNNs enables:	A	1	The network to attend to all positions in an input sequence simultaneously	The network to attend to the first layer only	Reducing the model size by half	Applying dropout at every layer
332	8	In CNNs, attention mechanisms are often combined with:	C	1	Fully connected layers	Pooling layers	Convolutional layers	Activation functions
333	8	Which type of attention focuses on specific regions of an image while ignoring others?	B	1	Soft attention	Hard attention	Layered attention	Selective attention
334	8	Which mathematical function is often used in attention mechanisms to weigh the importance of features?	A	1	Softmax	Sigmoid	ReLU	Tanh
335	8	What is the key difference between hard and soft attention?	A	1	Hard attention involves stochastic choices, while soft attention uses deterministic gradients	Soft attention uses stochastic choices, while hard attention uses fixed gradients	Hard attention only works in recurrent networks	Soft attention has no learnable parameters
336	8	Which model popularized the use of attention mechanisms?	A	1	Transformer	LSTM	VGG19	GAN
337	8	How do attention mechanisms help in handling long sequences in CNNs?	B	1	By reducing the number of layers	By applying focus to specific parts of the input	By increasing training data	By adjusting the learning rate
338	8	Attention mechanisms can be used to:	A	1	Improve spatial understanding in image classification	Reduce image resolution	Increase the size of the convolutional kernel	Decrease the accuracy of the model
339	8	Which of the following applications uses CNNs extensively?	B	1	Natural Language Processing	Image Classification	Financial Forecasting	Graph Theory

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340	8	CNNs are widely used in medical imaging for:	C	1	Noise reduction	Image compression	Detecting tumors and anomalies	Color balancing
341	8	Which practical application of CNNs involves object tracking in video sequences?	C	1	Image Classification	Image Enhancement	Object Detection	Data Augmentation
342	8	Which CNN-based system is widely used in self-driving cars?	B	1	Recurrent Neural Networks	YOLO (You Only Look Once)	K-means Clustering	Naive Bayes
343	8	In facial recognition, CNNs are primarily used to:	B	1	Segment background and foreground	Extract face embeddings	Apply image filters	Adjust brightness and contrast
344	8	What is the role of CNNs in natural scene text recognition?	C	1	Detecting keypoints in text regions	Performing image segmentation	Extracting features for text recognition	Blurring text regions
345	8	CNNs are used in video analytics primarily for:	B	1	Image synthesis	Object detection and motion analysis	Image compression	Noise filtering
346	8	Which CNN model is commonly used for fine-grained image classification tasks?	B	1	AlexNet	Inception	DenseNet	R-CNN
347	8	Which application of CNNs deals with enhancing resolution in low-quality images?	A	1	Image Super-Resolution	Object Segmentation	Data Normalization	Noise Reduction
348	8	In which field are CNNs used to improve satellite image interpretation?	C	1	Robotics	Astronomy	Remote Sensing	Medicine
349	8	What is the role of CNNs in image captioning systems?	B	1	Detecting objects in the image	Generating sentences to describe images	Filtering noise	Compressing the image
350	8	A transfer learning model has 16 layers. If the last 5 layers are fine-tuned and the rest are frozen, how many layers are not updated during training?	C	1	16	5	11	10
351	8	In transfer learning, a pre-trained CNN model has an accuracy of 80% on Task A . After fine-tuning the model for Task B, the accuracy improves by 15%. What is the final accuracy on Task B?	C	1	65%	80%	95%	90%
352	8	A CNN pre-trained model has 20 million parameters. After freezing 75% of the parameters, how many parameters remain trainable?	A	1	5 million	10 million	15 million	20 million
353	8	A model uses transfer learning with a batch size of 32 and trains for 10 epochs. If each epoch processes 6400 images, how many total images are processed?	B	1	3200	64,000	32,000	6,400

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354	8	In an attention mechanism, the input has a dimension of 512 and the attention weights reduce this to 256. What is the dimensionality reduction factor?	A	1	2	1.5	1.25	0.5
355	8	A self-attention mechanism processes a sequence of length 100 with a computation time proportional to the square of the sequence length. If processing 100 elements takes 10 milliseconds, how long will processing 200 elements take?	B	1	20 milliseconds	40 milliseconds	30 milliseconds	50 milliseconds
356	8	A CNN with an attention mechanism processes 128 filters per layer. If the attention mechanism reduces the filter size by 25%, how many filters remain after applying attention?	A	1	96	64	128	32
357	8	In an attention-based CNN model, the attention weights for a layer sum to 1. If 40% of the weight is assigned to the most important feature, what is the combined weight of the remaining features?	B	1	0.4	0.6	0.8	0.5
358	8	A CNN-based image classification model has 85% accuracy. If the dataset contains 10,000 images, how many images are classified correctly?	C	1	850	1500	8500	7500
359	8	A CNN object detection model processes a video at 25 frames per secon If the video is 2 minutes long, how many frames are processed in total?	A	1	3000	1500	4500	2500
360	8	A CNN model takes 10 milliseconds to classify one image. How long will it take to classify 1000 images?	A	1	10 seconds	100 milliseconds	1 seconds	10 milliseconds
361	8	In an object detection task, the CNN model achieves a precision of 90% and recall of 80%. What is the F1-score?	B	1	0.86	0.88	0.7	0.8
362	8	A pre-trained CNN model with 3 output classes is fine-tuned to classify a dataset with 5 output classes. If the model's softmax layer previously had 3 neurons, how many neurons does the updated softmax layer have?	B	1	3	5	4	2
363	8	A CNN-based image segmentation model has an input image size of 512x512. After applying a 2x2 max-pooling layer, what will be the output size?	A	1	256x256	128x128	512x512	1024x1024
364	8	A CNN model has an initial validation accuracy of 60%. After applying transfer learning, the validation accuracy improves by 20%. What is the new validation accuracy?	B	1	70%	80%	90%	50%
365	8	In a CNN model, if the stride of a convolutional layer is increased from 1 to 2, how does this affect the output size of the feature map?	C	1	Output size doubles	Output size remains the same	Output size reduces by half	Output size increases by half

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366	8	A CNN is trained on 1 million images. After fine-tuning, the training time reduces by 30%. If the original training took 100 hours, how long does the fine-tuned model take?	A	1	70 hours	30 hours	50 hours	90 hours
367	8	A model's accuracy improves from 50% to 75% using transfer learning. By what percentage did the accuracy improve?	B	1	25%	50%	75%	100%
368	8	A CNN model performs classification on a 4-class dataset. If the model predicts correctly on 750 out of 1000 samples, what is the accuracy?	B	1	50%	75%	60%	90%
369	8	In a CNN, a convolutional layer with a kernel size of 3x3 is applied to an input image of size 128x128. If no padding is used and stride is 1, what is the size of the output image?	A	1	126x126	128x128	124x124	125x125
370	8	What is transfer learning in the context of CNNs, and why is it useful for image classification tasks?		2				
371	8	Write a Python code to perform transfer learning using the VGG16 model for classifying a small dataset.		2				
372	8	If a transfer learning model achieves 95% accuracy in 10 epochs, whereas training from scratch takes 50 epochs to achieve the same accuracy, calculate the time saved.		2				
373	8	Discuss how fine-tuning works in transfer learning and its impact on model performance.		2				
374	8	Implement transfer learning using a ResNet model for classifying the Flowers dataset and compare its performance to training from scratch.		3				
375	8	In what scenarios would you recommend using transfer learning instead of training a CNN model from scratch?		3				
376	8	What are attention mechanisms in CNNs, and how do they improve model performance in tasks like object detection and image classification?		3				
377	8	Write a Python code to implement an attention mechanism in a CNN for image classification.		3				
378	8	If applying an attention mechanism improves the accuracy of a CNN from 88% to 92%, calculate the percentage improvement.		3				
379	8	Discuss three real-world applications of CNNs outside image classification, explaining how CNNs are used in each case.		5				
380	8	How are CNNs applied in medical image analysis, and what are the advantages of using CNNs for this purpose?		5				
UNIT 9 GENERATIVE ADVERSARIAL NETWORK (GAN) FOR IMAGE GENERATION								
TOPIC NAME: Introduction to GANs: GAN architecture (generator and discriminator),Training GANs: Loss functions and optimization,Applications of GANs								
379	9	What are the two main components of a GAN?	B	1	Generator and Tester	Generator and Discriminator	Encoder and Decoder	Transformer and Classifier

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380	9	What is the goal of the Generator in a GAN?	B	1	To generate real data samples	To fool the Discriminator with fake data samples	To distinguish between real and fake samples	To minimize the Discriminator's accuracy
381	9	Which loss function is used by the Discriminator in GANs?	C	1	Cross-Entropy Loss	Mean Squared Error	Binary Cross-Entropy Loss	Hinge Loss
382	9	What is a common issue during GAN training where the generator produces limited outputs?	C	1	Overfitting	Vanishing Gradients	Mode Collapse	Exploding Gradients
383	9	What type of data does the Generator in a GAN take as input?	B	1	Real-world data samples	Noise vector from a latent space	Discriminated data	Pre-processed images
384	9	In GANs, which of the following is true for the Discriminator during training?	B	1	It tries to maximize the Generator's performance	It tries to distinguish between real and generated samples	It generates fake data	It uses the latent space for training
385	9	What is the purpose of the latent vector z in a GAN?	A	1	It serves as a noise input to the Generator	It represents real data points	It is used for loss calculation in the Discriminator	It helps in data augmentation
386	9	Which of the following is a practical application of GANs?	B	1	Text-to-Speech	Image Generation	Regression Analysis	Sentiment Analysis
387	9	What is the key role of the Discriminator in a GAN?	C	1	Generate new data samples	Minimize its loss function	Differentiate between real and generated data	Optimize the latent vector
388	9	Which Python library is most commonly used to implement deep learning models, including GANs?	B	1	Pandas	TensorFlow	Matplotlib	Scikit-learn
389	9	Which function is typically used in Keras (within TensorFlow) to create a sequential model for GAN?	A	1	Sequential()	model()	Linear()	ConvNet()
390	9	In a GAN model implemented using TensorFlow/Keras, which layer is typically used as the output layer of the Discriminator?	C	1	Dense layer with softmax activation	Conv2D layer with ReLU activation	Dense layer with sigmoid activation	Dropout layer with linear activation
391	9	In GANs, which TensorFlow function is typically used to compile a model?	A	1	compile()	build()	initialize()	optimizer()
392	9	Which Python library is used along with TensorFlow to handle numerical operations and tensors efficiently?	A	1	NumPy	Pandas	Scipy	PyTorch
393	9	Which of the following is used to generate random latent vectors for the Generator in GANs using NumPy?	B	1	np.random.rand()	np.random.normal()	np.random.choice()	np.random.random()
394	9	Which function in TensorFlow/Keras is used to compile the Discriminator with a suitable optimizer and loss function?	A	1	discriminator.compile()	model.compile()	discriminator.build()	discriminator.optimize()
395	9	If the Discriminator predicts D(x)=0.9 for a real image, what is the Discriminator's loss for that image using the Binary Cross-Entropy loss function?	D	1	0.9	0.105	0.1	0.045
396	9	For a fake image, if the Discriminator predicts D(G(z))=0.3, what is the Discriminator's loss for that image using Binary Cross-Entropy?	B	1	0.125	0.522	0.845	0.625
397	9	For a Generator, if the Discriminator predicts D(G(z))=0.6, what is the Generator's loss using the modified non-saturating loss function?	C	1	0.511	0.654	0.221	0.114
398	9	If the Generator's loss is 0.693 and the Discriminator's loss is 0.916, what is the total loss for the GAN model?	A	1	1.609	1.052	2.0	0.845
399	9	If the Discriminator predicts D(x)=0.95 for real images and D(G(z))=0.05 for fake images, what is the total Discriminator loss?	D	1	0.0144	0.133	0.145	0.04455

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400	9	The Kalman Gain K in the Kalman filter depends on which factors?	A	1	Measurement noise covariance and predicted error covariance.	State transition matrix and measurement noise covariance.	State transition matrix only	initial and predicted state only
401	9	Write a code for creating a basic GAN model in Python using TensorFlow and Keras		2				
402	9	In a GAN, the Discriminator's loss function for a real sample is given by:LD=−log(D(x)). If the Discriminator predicts D(x)=0.85 for a real sample, calculate the Discriminator's loss for this sample.		2				
403	9	The Generator's loss function for a fake sample is given by: LG=−log(1−D(G(z))). If the Discriminator predicts D(G(z))=0.25 for a generated (fake) sample, calculate the Generator's loss.		3				
404	9	If the Generator's loss starts at 1.2 and decreases by 0.1 after each epoch, what will the loss be after 10 epochs?		3				
405	9	The initial loss of the Generator is 2.5, and it decreases by 0.15 per epoch. What will the loss be after 5 epochs?		3				
406	9	In a GAN, the Discriminator's loss function is defined asgiven below. Given that D(x)=0.9 for real data samples and D(G(z))=0.2 for fake samples, and N=100, compute the Discriminator's loss.		3				
407	9	$L_D = -\left(\frac{1}{N}\sum_{i=1}^{N}\log(D(x^{(i)})) + \frac{1}{N}\sum_{i=1}^{N}\log(1 - D(G(z^{(i)})))\right)$						
408	9	What is the difference between minimizing log(1 − D(G(z))) and maximizing log(D(G(z))) for the Generator? Why is the latter preferred		3				
409	9	What are the key components of the GAN architecture?		3				
410	9	How does the Generator improve during training?		3				
411	9	What is mode collapse in GANs, and how does it affect the Generator's output?		3				
412	9	Explain the role of loss functions in training GANs.		3				
413	9	List three practical applications of GANs in real-world scenarios.		3				
414	9	Why is the Discriminator critical to the success of a GAN model?		3				
415	9	How do GANs contribute to advancements in image generation?		3				
416	9	How would you modify the Discriminator model to classify real and fake images using TensorFlow/Keras?		5				
417	9	How can you train the Generator and Discriminator models together using a GAN model?		5				
418	9	Write a Python function to train the GAN model for a given number of epochs using real and fake images.		5				
419	9	Write a Python program to visualize the generated images from the Generator model after training.		5				
420	9	What are some of the challenges encountered during GAN training, such as mode collapse and vanishing gradients? How can they be mitigated?		5				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
421	9	Discuss the loss functions used in GANs for both the Generator and Discriminator. How do they contribute to the adversarial nature of the training?		5				
422	9	Describe some of the most common applications of GANs in image generation. Give examples.		5				
423	9	How does the Generator use the latent space to generate new data? Why is latent space important in GANs?		5				
424	9	Calculate Combined Loss for Discriminator and Generator for given data:D(x)=0.85 for real data, D(G(z))=0.25 for generated data ,Compute the Discriminator's loss and Generator's loss		5				
425	9	Consider a GAN where the Discriminator's output for a batch of N=5 samples is as follows: D(x)=[0.8,0.7,0.9,0.85,0.75] Generated samples D(G(z))=[0.2,0.3,0.1,0.25,0.15] Compute the individual Discriminator's loss also compute average Discriminator's loss		5				
UNIT 10 Motion detection and video processing								
TOPIC NAME:Optical Flow,Object Tracking,Video Capture and Processing,Video Generation								
426	10	Which algorithm is commonly used for estimating Optical Flow?	B	1	Canny Edge Detector	Lucas-Kanade Method	Gaussian Filter	Sobel Operator
427	10	What does Optical Flow represent in video processing?	B	1	Change in object shape	Movement of pixels between frames	Noise in the video	Image blurring
428	10	Which OpenCV function is used to compute dense Optical Flow?	C	1	cv2.calcOpticalFlowPyrLK	cv2.calcHist	cv2.calcOpticalFlowFarneback	cv2.findContours
429	10	In Optical Flow, the Brightness Constancy Assumption means:	A	1	The brightness of a point remains constant across frames	The brightness changes rapidly	The object's brightness fades with time	The brightness randomly fluctuates
430	10	Which method is used for feature-based object tracking in OpenCV?	A	1	KLT Tracker	Mean Shift Algorithm	Hough Transform	Histogram Equalization
431	10	Which video format is commonly used for capturing video frames in OpenCV?	A	1	AVI	PDF	MP3	JPEG
432	10	What does cv2.VideoCapture() function do in OpenCV?	C	1	Captures a still image	Starts a video recording	Reads frames from a video file or camera	Converts a video into a GIF
433	10	The Lucas-Kanade Optical Flow method is primarily used for:	B	1	Dense Optical Flow	Sparse Optical Flow	Edge Detection	Image Smoothing
434	10	In object tracking, what is the role of the Kalman Filter?	B	1	Filter out noise	Predict the object's future location	Identify multiple objects	Smooth motion of objects
435	10	What is the primary purpose of Optical Flow in motion detection?	C	1	To detect object color	To detect object speed	To detect motion patterns between consecutive frames	To detect object size
436	10	In Optical Flow, what does the term "warp" refer to?	C	1	Smoothing of frames	Frame interpolation	Motion compensation	Image sharpening
437	10	What function is used in OpenCV to write video frames to a file?	A	1	cv2.VideoWriter()	cv2.VideoStream()	cv2.VideoFile()	cv2.VideoLoad()
438	10	Which filter is commonly used to smooth video frames and reduce noise?	B	1	Median Filter	Gaussian Filter	Sobel Filter	Laplacian Filter

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439	10	What is the output of the cv2.VideoCapture.read() method in OpenCV?	B	1	A single frame in a video	A boolean value indicating success, and the frame	The total number of frames	The resolution of the video
440	10	In motion detection, background subtraction is used to:	C	1	Enhance contrast	Remove noise	Separate foreground objects from the background	Track multiple objects
441	10	In object tracking, the KLT (Kanade-Lucas-Tomasi) algorithm works best for:	B	1	Edges	Corners	Textures	Regions of uniform intensity
442	10	Which method combines motion prediction and estimation in tracking?	A	1	Kalman Filter	Camshift	Optical Flow	KLT Tracker
443	10	What is the key limitation of sparse Optical Flow algorithms?	B	1	Computational complexity	Limited accuracy for fast motion	High memory usage	Inability to track slow objects
444	10	In Optical Flow, the aperture problem refers to the:	A	1	Difficulty in estimating motion at object boundaries	Difficulty in tracking transparent objects	Difficulty in estimating motion for small apertures	Difficulty in detecting motion at high frame rates
445	10	In video processing, frame rate is measured in:	A	1	Frames per second (FPS)	Bits per second (bps)	Frames per minute (FPM)	Pixels per frame (PPF)
446	10	In motion detection, which method provides a fast way to detect significant changes in a scene?	B	1	Edge Detection	Background Subtraction	Optical Flow	Histogram Equalization
447	10	In video generation, which method can be used to create a slow-motion effect?	C	1	Frame interpolation	Edge detection	Background subtraction	Object tracking
448	10	Which of the following is commonly used to represent motion vectors in Optical Flow?	A	1	Arrows	Circles	Rectangles	Points
449	10	What is the key characteristic of a Kalman Filter in object tracking?	A	1	Predicts future states of a moving object	Reduces noise in video frames	Segments objects based on color	Detects corners in video frames
450	10	Which function in OpenCV is used to split a video into individual frames?	D	1	cv2.split()	cv2.extract()	cv2.read()	cv2.VideoCapture.read()
451	10	Which of the following describes the purpose of the cv2.VideoWriter() function?	C	1	To process Optical Flow	To capture frames from a video file	To write video frames to a file	To perform background subtraction
452	10	Which OpenCV function is used to draw bounding boxes around detected objects?	B	1	cv2.boundingRect()	cv2.rectangle()	cv2.findContours()	cv2.HoughLines()
453	10	Which of the following video frame properties can be retrieved using the cv2.VideoCapture.get() method?	B	1	Frame color depth	Frame size	Frame playback speed	Frame brightness
454	10	Which function is used in OpenCV to resize video frames?	A	1	cv2.resize()	cv2.shrink()	cv2.crop()	cv2.enlarge()
455	10	What is the primary challenge addressed by the aperture problem in Optical Flow?	A	1	Motion detection in uniform areas	Object occlusion	Background noise	Object speed estimation
456	10	Which filter is used to reduce noise in a video frame while preserving edges?	C	1	Gaussian Filter	Median Filter	Bilateral Filter	Laplacian Filter
457	10	Which function in OpenCV can be used to detect edges in video frames?	A	1	cv2.Canny()	cv2.calcHist()	cv2.meanShift()	cv2.medianBlur()
458	10	What is the key advantage of the Dense Optical Flow algorithm?	B	1	Fast computation	Provides motion information for all pixels	Low memory usage	Works well with small motion
459	10	What is the primary input required for computing Optical Flow between frames?	C	1	Frame size	Frame color	Pixel intensity change	Object shape

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
460	10	Which of the following describes Optical Flow in the context of motion estimation?	C	1	Flow of light in a video	Movement of objects in a scene	A representation of motion between consecutive frames	Reflection of light in different regions
461	10	Which of the following is used for blob detection in video processing?	A	1	cv2.SimpleBlobDetector()	cv2.HoughLines()	cv2.threshold()	cv2.erode()
462	10	The Kalman Gain K in the Kalman filter depends on which factors?	D	1	State transition matrix and measurement noise covariance.	Process noise covariance and initial state.	Predicted state and measurement matrix.	Measurement noise covariance and predicted error covariance.
463	10	Given a state prediction x^=[6 4], measurement z =5.5, and Kalman Gain K=[0.4 0.2], what is the updated state?	A	1	5.8,3.9	5.7,4.1	3.8,3.9	5.6,3,8
464	10	In a 3x3 window, the gradients are: Horizontal gradient(G_x) : $\begin{bmatrix}1\\1\\1\end{bmatrix}$, Vertical gradient$(G_y)$: $\begin{bmatrix}0\\0\\0\end{bmatrix}$, Temporal gradient$(I_t)$: $\begin{bmatrix}-1\\-1\\-1\end{bmatrix}$ What is the optical flow vector (u, v)?	C	1	0,0	0,-1	-1,0	-1,1
465	10	What assumption does the Lucas-Kanade method rely on?	B	1	Motion is large and irregular.	Brightness constancy across frames.	Velocity is non-linear.	There is no spatial gradient in images.
466	10	A robot moves in a straight line with an initial state vector: $x_0 = \begin{bmatrix}3\\2\end{bmatrix}$ (position = 3 m, velocity = 2 m/s). The state transition matrix is: $A = \begin{bmatrix}1 & 1\\0 & 1\end{bmatrix}$ and the measurement matrix is: $H = \begin{bmatrix}1 & 0\end{bmatrix}$ The predicted state at $t = 1$ second is:		3				
467	10	Explain the concept of Optical Flow and its significance in motion detection.		3				
468	10	Discuss the Lucas-Kanade method for Optical Flow and its practical applications.		3				
469	10	Describe how Object Tracking works in video processing. Provide examples of algorithms used to do same.		3				
470	10	How does the Kalman Filter assist in Object Tracking? Explain its role in motion prediction.		3				
471	10	Compare and contrast dense Optical Flow and sparse Optical Flow.		3				
472	10	Explain how background subtraction is used in motion detection for separating moving objects from a static background		3				

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473	10	Discuss the use of Video Capture and Processing in OpenCV. Write a Code to capture live video streams.		3				
474	10	What is the purpose of the cv2.VideoWriter() function in OpenCV, and how do you implement it?		3				
475	10	Explain the challenges of Object Tracking in video processing and how algorithms like Mean Shift and Camshift address them.		3				
476	10	How does frame interpolation work in video generation? Describe its role in creating slow-motion effects.		3				
477	10	Calculate the total number of frames captured in a 60-second video with a frame rate of 30 FPS.		3				
478	10	Given two consecutive frames of size 640x480, calculate the number of pixels where motion is detected if 10% of the pixels change.		3				
479	10	A video has a frame rate of 24 FPS. How many frames are captured in 10 minutes?		3				
480	10	Given a video of 120 seconds with a frame rate of 60 FPS, how many frames will be written to the video file if the capture drops 10% of the frames?		3				
481	10	Calculate the size of a 3-minute video (180 seconds) at 24 FPS, where each frame is 1 M		3				
482	10	Write a program to capture video from a webcam using OpenCV and display the frames.		3				
483	10	Write a program to detect motion using background subtraction.		3				
484	10	Write a program to perform edge detection on live video using the Canny Edge Detector.		3				
485	10	Write a program to track feature points using Optical Flow (Lucas-Kanade method)		3				
486	10	An object is moving in a straight line with an initial state vector:(position = 2 m, velocity = 3 m/s). The measurement at t=1 second is z 1=4.5 m. Use the following parameters to estimate the updated state using a Kalman filter:		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
487	10	A car is moving along a straight road, and we aim to estimate its position and velocity using a Kalman filter. The initial state of the car is: $x_0 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ (position = 0 m, velocity = 1 m/s). The measurement at $t = 1$ second is $z_1 = 2$ m. Use the following parameters to perform one complete iteration of the Kalman filter (Prediction and Update steps): 1. State transition matrix: $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ 2. Measurement matrix: $H = \begin{bmatrix} 1 & 0 \end{bmatrix}$ 3. Process noise covariance: $Q = \begin{bmatrix} 0.1 & 0 \\ 0 & 0.1 \end{bmatrix}$ 4. Measurement noise covariance: $R = 10$ 5. Initial error covariance: $P_0 = \begin{bmatrix} 1000 & 0 \\ 0 & 1000 \end{bmatrix}$ Perform the following steps: 1. Predict the state and error covariance. 2. Compute the Kalman Gain. 3. Update the state and error covariance based on the measurement.		3				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
488	10	We are given two frames of an image sequence: **Frame 1 (at t_1):** $\begin{bmatrix}10 & 20 & 30\\20 & 40 & 60\\30 & 60 & 90\end{bmatrix}$ **Frame 2 (at t_2):** $\begin{bmatrix}12 & 22 & 32\\24 & 44 & 64\\36 & 66 & 96\end{bmatrix}$ We aim to estimate the optical flow (motion vector (u, v)) at the center pixel $(2, 2)$ using the **Lucas-Kanade method.**		3				
489	10	Four pixels in a 2×2 window: | Pixel | (I_x) | (I_y) | (I_t) | | a | 2 | 1 | −4 | | b | 2 | 0 | −3 | | c | 1 | 1 | −2 | | d | 1 | 2 | −1 |		3				
490	10	A moving object is tracked by a Kalman filter. At time *t*, $x_t^- = \begin{bmatrix}4\\2\end{bmatrix}, \quad P_t^- = \begin{bmatrix}2 & 0\\0 & 2\end{bmatrix}$ The measurement is $z_t = \begin{bmatrix}5\\3\end{bmatrix}$ Given $H = I, \quad R = \begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$ Compute: 1 Kalman gain K_t 2 Updated state x_t 3 Updated covariance P_t		2				

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Sr No	Unit Number	Question_Text	MCQ Answer	Marks	Option A	Option B	Option C	Option D
491	10	A 1D Kalman filter has: $x=50, P=25, z=60, H=1, R=9$ Find: Kalman gain Updated state Updated variance		2				
492	10	An object's position and velocity are estimated using a 2D Kalman filter: $x_t^- = \begin{bmatrix}20\\5\end{bmatrix}, \quad P_t^- = \begin{bmatrix}6 & 0\\0 & 4\end{bmatrix}, \quad z_t = \begin{bmatrix}22\\6\end{bmatrix}, \quad R = \begin{bmatrix}3 & 0\\0 & 3\end{bmatrix}$ $H = I$. Find K_t, x_t, and P_t.		2				