CBCS SCHEME

17EC72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Digital Image Processing

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain with block diagram, the fundamental steps used in digital image processing. **(10 Marks)**

b. Explain with relevant diagrams, different sensor arrangements. **(10 Marks)**

OR

2 a. Explain the process of sampling and quantization, with relevant diagrams. **(10 Marks)**

b. Define following: (i) Spatial and Intensity Resolution (ii) 4-, 8- and m-adjacency (iii) Euclidean distance, city-block distance and chessboard distance **(10 Marks)**

Module-2

3 a. Explain with plots, some basic intensity transformation functions. **(10 Marks)**

b. With relevant equations, discuss the discrete Laplacian of two variables and different implementation of Laplacian operator masks. **(10 Marks)**

OR

4 a. Discuss with relevant diagrams, the image smoothing using the frequency domain low pass filters (i) Ideal (ii) Butterworth (iii) Gaussian **(10 Marks)**

b. Explain the following selective filter: (i) Bandreject and Bandpass Filters (ii) Notch Filters **(10 Marks)**

Module-3

5 a. Discuss various noise models with respect to image restoration process. **(10 Marks)**

b. Explain the following methods for estimating degradation function: (i) Estimation by image observation (ii) Estimation by experimentation **(10 Marks)**

OR

6 a. Explain the process of restoration of images using Inverse Filtering technique. **(10 Marks)**

b. Explain with relevant equations, Minimum Mean Square Error (Wiener) Filtering. **(10 Marks)**

Module-4

7 a. Explain the following color models: (i) RGB (ii) HSI **(10 Marks)**

b. Explain Pseudocolor Image Processing. **(10 Marks)**

OR

8 a. Explain the following Morphological operations: (i) Erosion (ii) Dilation (iii) Opening (iv) closing **(10 Marks)**

b. Explain multi-resolution expansions used in image processing. **(10 Marks)**

Module-5

9 a. Explain Thresholding based segmentation. Discuss: (i) Global Thresholding (ii) Adaptive Thresholding **(10 Marks)**

b. Explain segmentation of images using Morphological Watersheds. **(10 Marks)**

OR

10 a. Explain Chain Codes used to represent a boundary. **(10 Marks)**

b. Discuss various approaches of boundary description. **(10 Marks)**

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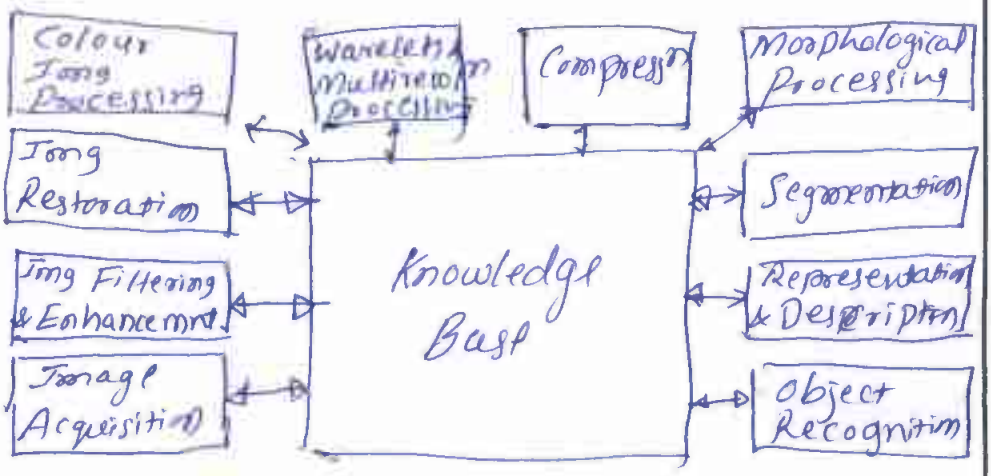
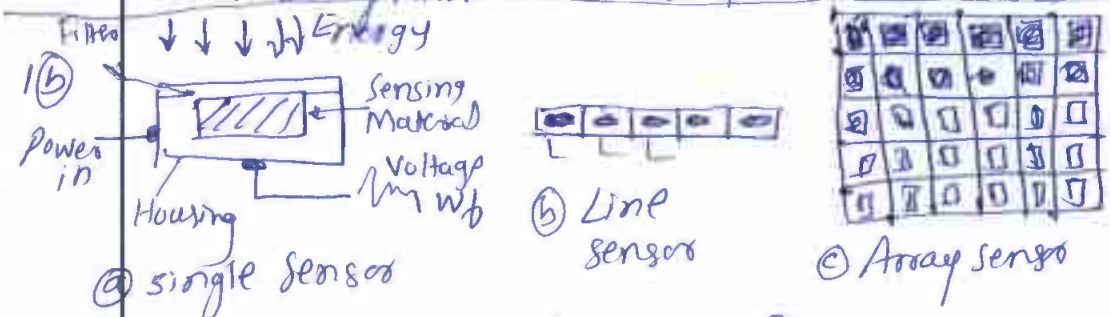
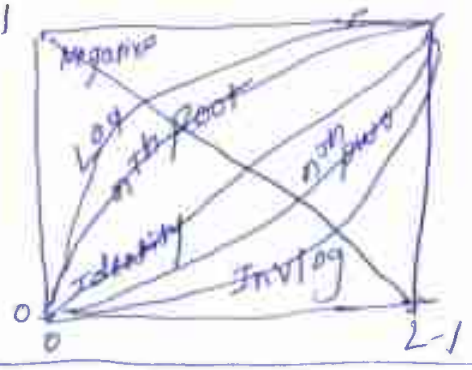
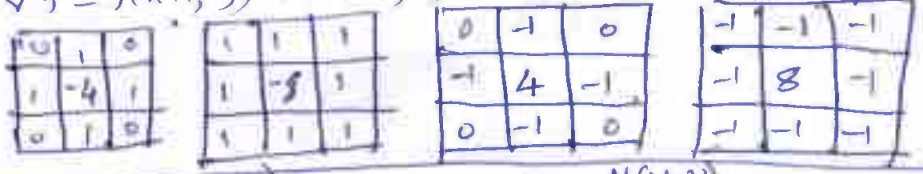
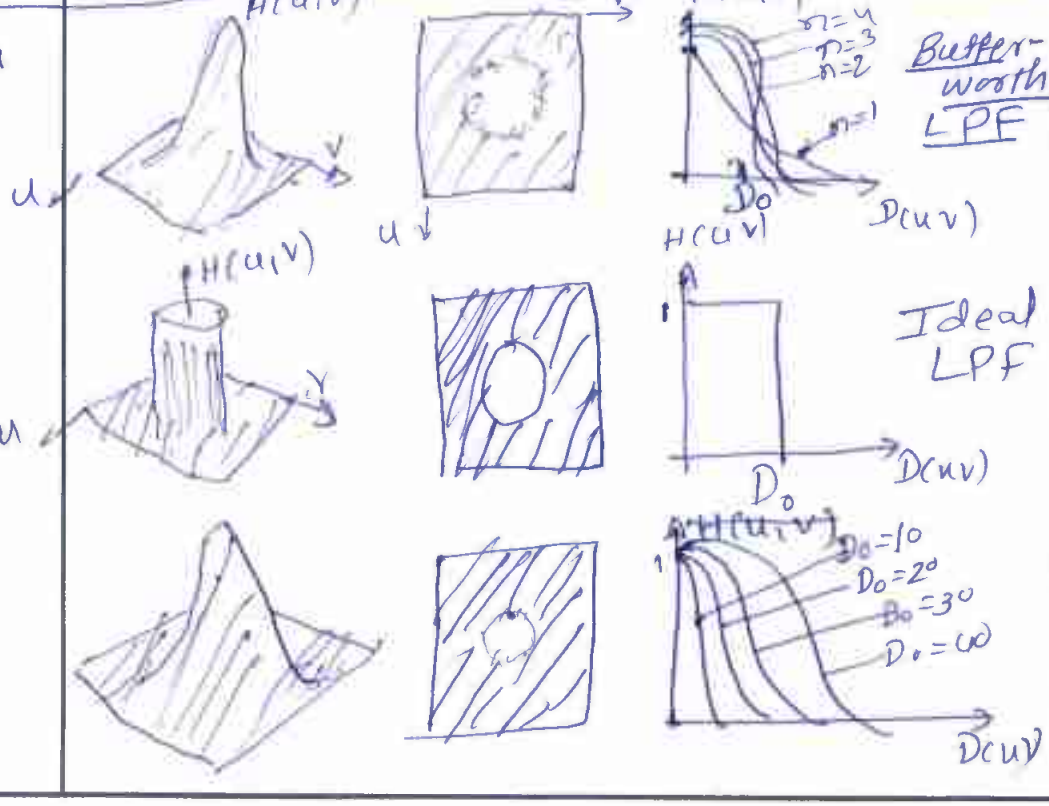
Scheme & Solutions

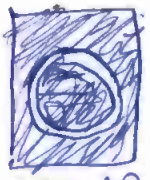
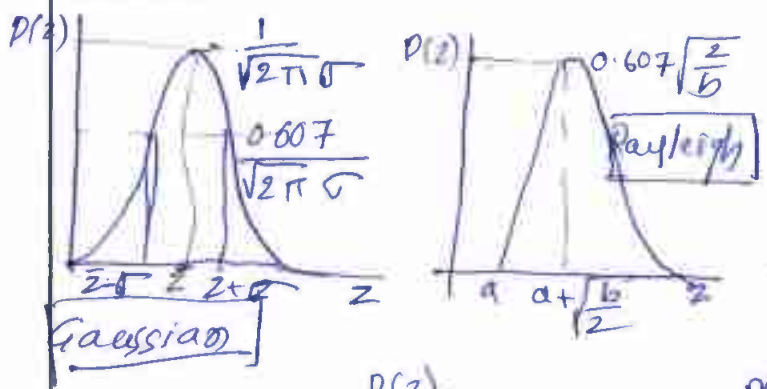
Subject Title : **Subject Code :** 17EC72

Question Number	Solution	Marks Allocated
1(a)	Module 1  Block Diagram → 2M Explanation → 8M	10M
1(b)	 Diagram → 2M Explanation → 8M	10M
2(a)	 Diagram – 2M Explanation – 8M	10M
2b	Definition of: Spatial Resol^n → 2M Intensity Resol^n → 2M 4-Adj – 1M ; 8-Adj → 1M ; m-adjacency Distances: Euclidean → 1M ; City Block – 1M ; Chess Board – 1M	

Subject Title : **Subject Code :**

Question Number	Solution	Marks Allocated
	Module 2	
3a	 Diagram – 2M Expln → 2M	10M
3b	$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$ $\frac{\partial^2 f}{\partial x^2} = f(x+1, y) + f(x-1, y) - 2f(x, y)$ $\frac{\partial^2 f}{\partial y^2} = f(x, y+1) + f(x, y-1) - 2f(x, y)$ $\nabla^2 f = f(x+1, y) + f(x-1, y) + f(x, y+1) + f(x, y-1) - 4f(x, y)$ 	
4a		10M (Diagrams of plots → 3M Expln → 7M)

Subject Title : **Subject Code :**

Question Number	Solution	Marks Allocated
4b	 Band Reject Gaussian Filter  Band Pass Filter Band reject / Band pass Filter Explanation → 4M Notch Filter → 4M Explain. Diagrams of plots → 2M	10M
	Module 3	10M
5a	Noise Models : 	Diagrams 4M Expln → 6M
5b	Estimation by Observn :- $H_s(u,v) = \frac{G_s(u,v)}{F_s(u,v)}$ $G_s(u,v)$ - F.T of observed image $F_s(u,v)$ - F.T of Processed img. → 4M $H(u,v)$ → Degradation Fn. Estimation by Experiment : $H(u,v) = \frac{G(u,v)}{A}$ $G(u,v)$ → FT of Observed img ; A → const. described strength of impulse	10M
6a	$\hat{F}(u,v) = \frac{G(u,v)}{H(u,v)} = F(u,v) + \frac{N(u,v)}{H(u,v)}$ (4M) +Explanation (6M)	10M

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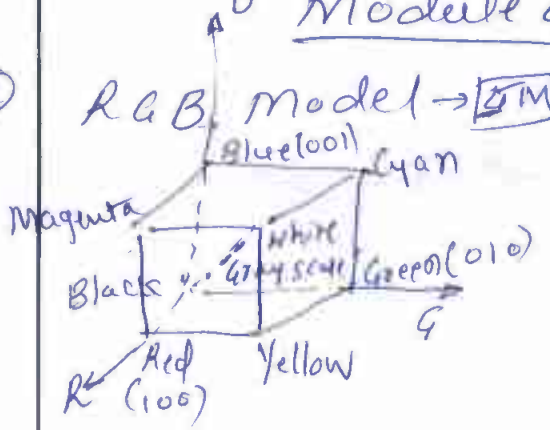
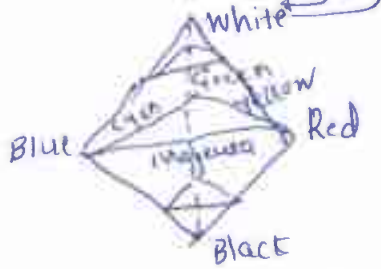
Question Number	Solution	Marks Allocated
6b	Wiener Filter. → deals with both — degradⁿ fn & statistical chs of noise → $e^2 = E\{(f - \hat{f})^2\}$ → $\hat{F}(u,v) = \left[\frac{1}{H(u,v)} \frac{|H(u,v)|^2}{|H(u,v)|^2 + S_h(u,v)/S_f(u,v)}\right] G(u,v)$ ⇓ Prod of complex quatity with its Conjugate is equal to magni of complex quantity square. → 4M Explanation → 6M	10M
7a	Module 4 RGB model → 5M | HSI model - 4M → 10M   Diagrams - 2+2 = 4M Explanation - 3+3 = 6M	
7b	Explain of Pseudocolor processing → 6M Diagram - 4M	10M
8a	Explanation of: Erosion (2.5M); Dialation (2.5M); Opening (2.5M); Closing (2.5M).	10M
8b	Explanation of Multiresolution Expansion → 6M Diagrams — 4M	10M

Subject Title : **Subject Code :**

Question Number	Solution	Marks Allocated
	Module 5	
9a	Thresholding based segmentation – 4M Global Thresholding – 3M Adaptive Thresholding – 3M	10M
9b	Segmentation of images using Morphological Watersheds – 6M Diagrams – 4M	10M
10 a	Chain Codes used to represent boundary Explanation – 6M ; Relevant Diagrams – 4M	10 M
10 b	– Simple Descriptors — (2.5 M) (Diameter, Curvature) – Shape Numbers — (2.5M) – Fourier Descriptor — (2.5M) – Statistical Moments — (2.5 M)	10M