Department of Forensic Science

Revised Syllabus of III Year Diploma Program (UG)

Title of Program: Forensic Image Processing

Syllabus Structure (UG)

Year	Semester	Course No.	Course Code	Contact Hours	Credits (1Credit=15 H)	Total Marks
2	V	CT V	DFSCT 505	30	2	75
		CLV	DFSCL505	60	2	75
	VI	CT VI	DFSCT 606	30	2	75
		CL VI	DFSCL606	60	2	75
	Annual	CP III	DFSCP303	60	2	100
	Industrial and or Incubation and or Research and or Field Training			30	1	-
		Total		**270**	**11**	**400**

D: Diploma, *: Departmental Code (C: Chemistry, MI: Microbiology, CSE: Computer Science (Entire), etc)

C: Course, T: Theory, L: Lab (Practical), P: Project

Total No. of Courses: 6 (Theory: 02, Practical: 02, Project: 01)

Theory and Practical: Semester, Project: Annual

Semester V

CT-III: DFSCT 505: Title: Forensic Image Processing

(Contact Hrs: 30 Credits: 2)

Learning Objectives:

Students will be able to

1. Studying the Matrix and set theory in image processing.
2. Studying the image enhancement and edge detection operations.

Unit I: Mathematics preliminaries and Image Fundamentals: (15)

Matrix Algebra: Definitions, matrix arithmetic, transpose, powers, trace and determinant of matrices.
Set Theory: definition and representation of set, subset and power set, associative, commutative and distributive properties of set, definition and concepts of function.
Basic concepts of co-ordinate geometry, complex numbers and derivatives.
Image Fundamentals: definition and types of image, co-ordinate convention, Human visual system and computer vision system, digitization and Shannon sampling theorem, zooming and shrinking of an

image, relationship between pixels: neighbors, adjacency, connectivity and path, Distance measures between pixels.

Unit II: Image Enhancement and Edge detection operators (15)

Introduction and scope of image enhancement, Image enhancement in Enhancement: Spatial Domain: Gray level transformations – Histogram processing – Basics ofSpatial Filtering– Smoothing and Sharpening Spatial Filtering. Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement, Image restoration and image segmentation.

Edge detection operators: Sobel, Prewitt, Roberts, Canny and Laplacian operators

Learning Outcomes:

After completion of the unit, Student is able to learn

1. Matrix Algebra, Set Theory, Image Fundamentals and Visual system and relationship between pixels
2. image enhancement and Edge detection operators

Reference Books:

1. Rafel C. Gonzalez and Richard E. Woods, *Digital Image Processing*, Person Education. 3rd and 4th edition.
2. Chanda Bhabatosh and Majumdar Dwijesh Dutta, *Digital Image Processing and Analysis*, Prentice Hall of India, 2004
3. C. Georgiadis, Prof. Ioannis Pitas, *Digital Image Processing*, Aristotle University of Thessaloniki.

CL-III: DFSCL505: **Title (Practical): Forensic Image Processing Lab**

(Contact Hrs: 60 Credits: 02)

Learning Objectives:

Students will be able to

1. Understand the read and write of a digital image
2. Understand the matrix and array operation.
3. Understand the image enhancement.
4. Understand the edge detection.

List of Practical's (15)

1. To perform simple processing on image in MATLAB.
2. To perform matrix and array operation in MATLAB.
3. Write a MATLAB code for read and write of a digital image.
4. To read and show the given image into a file by using MATLAB.
5. To resolve the R-G-B components of an image in MATLAB.
6. Calculate the following distance between two given vectors using MATLAB.
7. To apply various filters on the given image using MATLAB.
8. Write a MATLAB code for enhancement of image using mean and median filters
9. Write a MATLAB code for enhancement of image using low pass and high pass filters
10. To create function to perform histogram equalization on given image.
11. To apply various operators for edge detection of the given image using MATLAB.
12. Write a MATLAB code for edge detection using Sobel operator
13. Write a MATLAB code for edge detection using Prewitt operators
14. Write a MATLAB code for edge detection using Canny operators
15. Write a MATLAB code for edge detection using Laplacian operators

Learning Outcomes:

After completion of the unit, Student is able to

1. Working with read and write digital image, matrix and array operation.
2. Working with image enhancement, edge detection.

References:

1. Mark Nixon, *Feature Extraction and Analysis*, Kindle Edition.
2. C. Georgiadis, Prof. Ioannis Pitas, *Digital Image Processing*, Aristotle University of Thessaloniki. Anil Kumar Jain, *Fundamentals of digital image processing,* Prentice Hall Information and System Sciences series.
3. Husrev Taha Sencar, *Digital Image Forensics There is more to a Picture than Meets the Eye,* Springer, 2012.
4. Judith A. Redi & Wiem Taktak & Jean-Luc Dugelay, *Digital image forensics: a booklet for beginners,* Springer 2010.

Semester VI

CT-IV: DFSCT 606: Title: Forensic Image Processing
(Contact Hrs: 30 Credits: 2)

Learning Objectives:

Students will be able to

a. Learn the science of image representation, morphological concepts and different transformations.

b. Learn the science of image forensics and steganography and watermarking.

Unit I: Image Description and Representation: (15)

Mathematical morphology: basic morphological concepts, binary dilation and erosion, opening and closing, hit-or-miss transformation, gray-scale dilation and erosion, opening and closing, top hat and geodesic transformation.

Compression: basic concepts of image compression, redundancy and fidelity criteria, image compression models, lossy com pression: vector quantization, loss less compression: run length coding, Huffman transformation, JPEG compression.

Unit II: Image Forensics (15)

Introduction and scope of image forensics, **Source Identification:** overview of image source identification, digital camera and image sensors, identification based on sensor defects and physical defects.

Authentication of image evidence: image tampering and its type, detection of image tampering based on scene, optics, sensor, and processing and image property.

Steganography and digital watermarking: introduction and scope of Steganography and digital watermarking, comparative study Steganography and digital watermarking, basic concepts of Steganography and digital watermarking models, basic concepts of digital watermarking security and steganalysis.

Learning Outcomes:

After completion of the unit, Student is able to

1. Students will get deep knowledge about science of image description and representation.
2. Students will get deep knowledge about morphological concpets and different tranformations.
3. Students will get deep knowledge about the science of image forensics.
4. Students will get deep knowledge about the steganography and watermarking.

References:-

1. Mark Nixon, *Feature Extraction and Analysis*, Kindle Edition.
2. C. Georgiadis, Prof. Ioannis Pitas, *Digital Image Processing*, Aristotle University of Thessaloniki. Anil Kumar Jain, *Fundamentals of digital image processing,* Prentice Hall Information and System Sciences series.
3. Husrev Taha Sencar, *Digital Image Forensics There is More to a Picture than Meets the Eye,* Springer, 2012.
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5. Rafel C. Gonzalez and Richard E. Woods, *Digital Image Processing*, Person Education. 3rd and 4th edition.
6. Chanda Bhabatosh and Majumdar Dwijesh Dutta, *Digital Image Processing and Analysis*, Prentice Hall of India, 2004
7. C. Georgiadis, Prof. Ioannis Pitas, *Digital Image Processing*, Aristotle University of Thessaloniki.

CL-IV: DFSCL 606: **Title (Practical): Forensic Image Processing Lab**
(Contact Hrs: 60 Credits: 02)
Learning Objectives:

Students will be able to

1. Understand the implementing gray-scale morphological operations.
2. Understand the implementing binary morphological operators.
3. Learn image tampering detection.
4. Understand various filters implementation process.

List of Practical's (15)

1. To perform morphological processing on given digital image.
2. To study the effect of the size of neighbourhood on the result of processing.
3. Write a MATLAB code for implementing gray-scale morphological operators
4. Write a MATLAB code implementing binary morphological operators.
5. To learn to use arithmetic operations to combine images.
6. Study the thresholding-based segmentation technique
   a) Understand how the threshold can be selected from the image histogram and its effect on segmentation performance
   b) Understand the difference between single and double thresholding.
7. Write a MATLAB code for image tampering detection
8. Enhance a fingerprint image using various filters.
9. To Count the number of pixels at every grey level K.
10. Enhance image using various filters.
11. To compress the image by using lossy compression.

12. To compress the image by using lossless compression.
13. To study the digital watermarking on given image.
14. To study the Steganography on given image.
15. To study the digital watermarking security and steganalysis

Learning Outcomes:

After completion of the unit, Student is able to

1. Understand morphology of image
2. understand compression of image
3. Understand feature extraction process.
4. Understand image tampering detection techniques.

References

1. Mark Nixon, *Feature Extraction and Analysis*, Kindle Edition.
2. C. Georgiadis, Prof. Ioannis Pitas, *Digital Image Processing*, Aristotle University of Thessaloniki. Anil Kumar Jain, *Fundamentals of digital image processing,* Prentice Hall Information and System Sciences series.
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7. C. Georgiadis, Prof. Ioannis Pitas, *Digital Image Processing*, Aristotle University of Thessaloniki.

CP-II: DFSCP303: Project

(Contact Hrs. 30, Credits: 1)

Industrial and or Incubation and or Research and or Field Training

(Contact Hrs. 30, Credits: 1)

BOS Sub-Committee

1. Miss.M.S. Bagul	Department of Forensic Science
2. Mr. S. S. Thorat	Department of Forensic Science
3. Miss. P.B. Dahotere	Department of Forensic Science

Expert Committee

1. Miss. Vini Kale	Government Institute of Science Aurangabad.
2. Mr. Sushil Sankpal	SGMCOE Gadhinglaj.