

Name of Institute: Institute of Technology & Engineering Name of Faculty: Dr. Vrushank Shah

Course code EC0623 Course name: Image Processing Pre-requisites: Signals & Systems & D

Pre-requisites: Signals & Systems & Digital Signal Processing Credit points: 4 Offered Semester: 6th

Course coordinator (weeks 01 - 14)

Full name: Dr. Vrushank Shah Department with siting location: Electronics & Communication Engineering Telephone: 9898331721 Email: vrushankshah.ec@indusuni.ac.in Consultation times: 09.00 AM – 10.00 AM (Working Saturdays)

Course lecturer (weeks 01 - 14)

Full name: Dr. Vrushank Shah Department with siting location: Electronics & Communication Engineering Telephone: 9898331721 Email: vrushankshah.ec@indusuni.ac.in Consultation times: 09.00 AM – 10.00 AM (Working Saturdays)

Students will be contacted throughout the session via mail with important information relating to this course.

Course Objectives

By participating in and understanding all facets of this course a student will:

- 1. Describe and explain basic principles of digital image processing.
- 2. Design and implement algorithms that perform basic image processing (e.g.noise removal and image enhancement).
- 3. Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).
- 4. Assess the performance of image processing algorithms and systems.

Course Outcomes (CO)

- 1. Understand image formation and the role human visual system plays in perception of gray and color image data. Get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense.
- 2. Learn the signal processing algorithms and techniques in image enhancement and image restoration.



- 3. Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems. Filter given image using frequency domain filtering technique.
- 4. Select the right image restoration technique to remove degradation from given image & Understand the various kind of noise present in the image and how to restore the noisy image
- 5. Be able to conduct independent study and analysis of image processing problems and techniques.



Course Outline

CONTENTS

UNIT-I

Introduction

Introduction to Digital Image Processing & Applications, Sampling, Quantization, Basic Relationship Between Pixels. Imaging Geometry. Image interpolation.

UNIT-II

Image enhancement and filtering in spatial domain:

Intensity transformation functions: Contrast stretching, Thresholding, Image negative, Log transformation, Power - low transformation, Intensity level slicing and Bit - plane slicing.

Image histogram, Histogram equalization process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering (sharpening).

UNIT-III

Image filtering in the frequency domain:

Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering, 2D-DFT, 2D-FFT, 2D-DCT,Fundamentals of 2D-wavelet transform, Image pyramids, sub-band coding.

Image restoration:

Reasons for image degradation, Model of image degradation/restoration process, Noise probability density functions, Image restoration using spatial filtering (Mean filters, Order statistic filters and adaptive filters), Inverse Filtering, MMSE (Wiener) Filtering.

Colour Image Processing:

Colour Fundamentals, Colour Models, Pseudo – colour image processing.

UNIT-IV

Image Compression:

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard, Wavelet based image compression.

Image Segmentation:

Edge based segmentation, Region based segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding.

Morphological Image Processing:

Basic morphological operations, Erosion, dilation, opening, closing,

[16 hours]

[16 hours]

[5 hours]

[8hours]



Structuring elements, Hit -

Or - Miss transform, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons, Reconstruction by erosion and dilation

TEXT BOOKS :
1. Digital Image Processing by Rafael C Gonzalez & Richard E Woods, 3rd
Edition
2. Digital Image Processing by William K Pratt
REFERENCE BOOKS:
1. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar,
Tata McGraw Hill Publication.
Digital Image Processing, S Sridhar, Oxford University Press.
WEB RESOURCES:
 <u>https://onlinecourses.nptel.ac.in/noc16_ec14</u>
2. https://nptel.ac.in/syllabus/117105079/

Method of delivery

- 1. Chalk and talk
- 2. PowerPoint Presentations
- 3. Self-study material
- 4. NPTEL notes

Study time

3 hours per week Lectures and 2 Hours practical per week

CO-PO	Mapping	(PO:	Program	Outcomes)
-------	---------	------	----------------	-----------

	PO 1	PO 2	РО 3	РО 4	РО 5	РО 6	РО 7	PO 8	РО 9	PO1 0	PO1 1	PO1 2
CO 1	\checkmark											
CO 2	\checkmark				\checkmark							
CO 3	\checkmark	\checkmark	\checkmark		\checkmark							
CO 4	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark					\checkmark
CO 5	\checkmark					\checkmark						



Blooms Taxonomy and Knowledge retention (For reference) (Blooms taxonomy has been given for reference)



Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department ofGraduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	1 Professional knowledge, grounding & awareness



Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	2 Information literacy, gathering & processing
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	4 Problem solving skills
Effective communicators	5 Written communication
Articulate ideas and convey them	6 Oral communication
effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	7 Teamwork
Responsible	10 Sustainability, societal &
Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	environmental impact

Practical work:

1.	To write and execute image processing programs using point processing method Obtain Negative image
	Obtain Flip image
	Thresholding
	Contrast stretching
2.	To write and execute programs for image arithmetic & logical operations operations Addition of two images



	Subtract one image from other image							
	Calculate mean value of Image							
	Different Brightness by changing mean value							
	AND operation between two images							
	OR operation between two images							
	Calculate intersection of two images							
	Water Marking using EX-OR operation							
	NOT operation (Negative image)							
3.	To write a program for histogram calculation and equalization							
4.	To write a program for Bit plane slicing & Spatial resolution							
5.	To understand various image noise models and to write programs for							
	image restoration							
	Remove Salt and Pepper Noise							
	Minimize Gaussian noise							
	Median filter and Weiner filter							
6.	Write and execute programs to remove noise using spatial filters							
7.	To write a program for JPEG compression							
8.	Write and execute programs for image frequency domain filtering							
	Apply FFT on given image							
	Perform low pass and high pass filtering in frequency domain							
	Apply IFFT to reconstruct image							
9.	Write a program for edge detection using different edge detection mask							
10	Write and execute program for image morphological operations erosion and dilation.							
11	To write and execute program for wavelet transform on given image							
	and perform inverse wavelet transform to reconstruct image.							

Lecture/tutorial times

(Give lecture times in the format below)



Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

Details of referencing system to be used in written work

- 1. Text Books and Reference Books
- 2. Online Resources

Text books

Mention in syllabus

Additional Materials

- 1. https://onlinecourses.nptel.ac.in/noc16_ec14
- 2. https://nptel.ac.in/syllabus/117105079/

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e internal component or end

EC0623 Open Elective, 6th EC: 2021 (3rd Year)



semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of 10 % of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.

Do not share your work with other students (except where required for a group activity or assessment)



.

Course schedule (subject to change) (Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	Introduction Introduction to Digital Image Processing & Applications, Sampling, Quantization, Basic	C01	Chalk and talk PowerPoint Presentations
	Weeks 2	Relationship Between Pixels. Imaging Geometry. Image interpolation Intensity transformation functions	C01	Chalk and talk PowerPoint Presentations
	Week 3	Contrast stretching, Thresholding, Image negative, Log transformation, Power - low transformation, Intensity level slicing and Bit - plane slicing. Image histogram, Histogram equalization process.	CO1 CO2	Chalk and talk PowerPoint Presentations
	Week 4	Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing)	CO2	Chalk and talk PowerPoint Presentations
	Week 5	high pass filtering (sharpening). Image filtering in the frequency domain: Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering	C03	Chalk and talk PowerPoint Presentations
	Week 6	2D- DFT, 2D-FFT, 2D- DCT,Fundamentals of 2D- wavelet transform, Image pyramids, sub-band coding.	C03	Chalk and talk PowerPoint Presentations

Week 7	Image restoration: Reasons for image degradation, Model of image degradation/restoration process, Noise probability density functions,	C04	Chalk and talk PowerPoint Presentations
Week 8	Image restoration using spatial filtering (Mean filters, Order statistic filters and adaptive filters), Inverse Filtering, MMSE (Wiener) Filtering.		Chalk and talk PowerPoint Presentations
Week 9	Colour Image Processing: Colour Fundamentals, Colour Models, Pseudo – colour image processing.	<i>CO4CO5</i>	Chalk and talk PowerPoint Presentations
Week 10	Image Compression: Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding,	CO5	Chalk and talk PowerPoint Presentations
Week 11	JPEG Compression standard, Wavelet based image compression Image Segmentation: Edge based segmentation, Region based segmentation, Region split and merge techniques,	CO4 C05	Chalk and talk PowerPoint Presentations
Week 12	Regiongrowingbypixelaggregation,optimalthresholding.MorphologicalImageProcessing:Basicmorphologicaloperations,Erosion, dilation,opening,closing,Structuringelements,	C05	Chalk and talk PowerPoint Presentations
Week 13	Hit -Or - Miss transform, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons,	C05	Chalk and talk PowerPoint Presentations
Week 14	Reconstruction by erosion and dilation Revision		

💿 🔳 ज्ञानेन प्रकाशते जगत्

