BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 16.01.2021

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No : BITS F311
Course Title : Image Processing
Instructor-in-Charge : Raj Kumar Gupta
Instructor(s) : NA
Tutorial/Practical Instructors: NA

1. Course Description: This is a first course on digital image processing. It begins with an introduction to the fundamentals of digital images and discusses the various discrete transforms, which are extensively used in the field of image processing. The course discusses different image processing techniques essential for image enhancement, image restoration and image compression. Finally, it briefly touches upon automatic image classification and recognition.

2. Scope and Objective of the Course: The course introduces the students to the fundamentals of digital images and various processing techniques that are applied to them so as to improve their quality. These techniques are essential for image enhancement, image restoration and image compression. It also briefly introduces automatic image classification and recognition. Matlab software will be introduced to the students so as to improve their skills in writing codes related to image/data processing.

3. Text Books: Gonzalez, R. C. & R. E. Woods, Digital Image Processing, Pearson.

4. Reference Books: Foundations of Coding, Jiri Adamek, Wiley, 1991

5. Course Plan:

Module No.	Lecture Session	Reference	Learning outcomes
1-3	Introduction and digital image fundamentals.	Chapter 2	To introduce fundamental concepts and terms associated with digital images.
4	Image enhancement	Chapter 3	To introduce the concept of image enhancement
5-6	Some basic gray level transformations	Chapter 3	To study image enhancement by gray level transformations
7-8	Histogram processing	Chapter 3	To study Histogram processing of an image
9-10	Spatial filtering	Chapter 3	To learn image enhancement by filtering in the spatial domain
11-13	Fourier Transform, Discrete Fourier Transform and their properties.	Chapter 4	To introduce Fourier Transform and Discrete Fourier Transform

14-15	Convolution & Correlation theorems, auto-correlation	Chapter 4	To introduce convolution and establish connection with Fourier transform
16-17	Fast Fourier Transform	Chapter 4	To study the Fast Fourier Transform algorithm
18 – 19	Filtering in the frequency domain	Chapter 4	To learn image enhancement by filtering in the frequency domain
20	Image degradation model,	Chapter 5	To introduce image degradation and degradation model
21 – 22	Removal of blur caused by uniform linear motion	Chapter 5	To learn how to remove blur caused by uniform linear motion
23	Inverse filtering	Chapter 5	To learn inverse filtering
24 – 25	Fundamentals of image compression	Chapter 8	To introduce the fundamentals of image compression
26 – 27	Kraft's inequality, Huffman codes	Chaps 1 & 2 of ref. book 2	To introduce basics of coding theory
28 – 30	Entropy and data compression	8.3.4, Chap 3 of ref. Book 2	To introduce the basics of Information theory
31 – 33	near optimal variable length codes, Arithmetic and LZW coding, run-length coding etc.	Chapter 8	To learn various error- free compression techniques
34 – 36	Lossy compression, Image compression standards	Chapter 8	To learn various lossy compression techniques and learn some image compression standards
37 – 38	Image segmentation	Chapter 10	To learn some image segmentation techniques
39 – 40	Image representation and classification	Chapter 11 & 12	To introduce the idea of image classification and pattern recognition

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	30	<TEST_1>	Closed/open
Comprehensive Examination	2 h	35	<TEST_C>	Closed/open
Quiz/Assignment/Coding/etc		35	Announced in class	Closed/open

7. Chamber Consultation Hour: To be announce in the class

8. Notices: Nalanda website, google classroom

9. Make-up Policy: As per Institute rule

10. Note (if any):

Instructor-in-charge
Course No. BITS F311