Birla Institute of Technology & Science, Pilani
Hyderabad Campus

First Semester, 2022-2023
Course Handout (Part II)

29-08-2022

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: Dr. Abhijit Das

Course Description: This is a course to envoy knowledge 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 image processing. It then discusses the different image processing techniques such as color image processing, morphological operation, image enhancement, automatic image classification and recognition.

Scope & Objectives: 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 image enhancement, automatic image classification and recognition.

The objectives of the course are:

- To provide a comprehensive understanding of the foundational and other essential concepts involved on digital image processing.
- To introduce various discrete transforms, morphological operation, and image enhancement which are extensively used in image processing.
- To introduce the current advancements in image processing such as object recognition and pattern recognition.

Text Book: Gonzalez, R. C. & R. E. Woods, Digital Image Processing, Pearson Education, 4th ed., 2016.

Reference Books:

1. Algorithms for image processing and computer vision. Parker, Jim R., John Wiley & Sons, 2010.
2. Learning OpenCV 4 Computer Vision with Python 3: Get to Grips with Tools, Techniques, and Algorithms for Computer Vision and Machine Learning, 3rd Edition by Joe Minichino and Joseph Howse, 2020.
3. Deep Learning for Vision Systems, 1st Edition by Mohamed Elgendy, Manning, 2020.

Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	To introduce fundamental concepts and terms associated with digital images.	Introduction and digital image fundamentals.	Chap 1 and 2
2-3	To study image enhancement by gray level transformations	Some basic gray level transformations	Chap 3 Sec. 3.1, 3.2
4-6	To study Histogram processing of an image	Histogram processing	Chap 3 Sec 3.3
7-8	To learn image enhancement by filtering in the spatial domain	Spatial filtering	Chap 3 Sec. 3.4-3.7
9-11	To review the Fourier domain techniques	Fourier Transforms, DFT, Convolution	Chap 4 4.1-4.6
12-14	To understand Filtering in the Fourier domain	Image smoothing and sharpening using frequency domain filters	Chap 4 4.7-4.10
15-17	To understand Image Restoration and Reconstruction	Noise models, Inverse filtering	Chap 5 5.1-5.7
18-20	To understand Color image processing	color fundamental, models, pseudo image processing, color transformation, color smoothing and sharpening, compression	Chap 6 6.1-6.7
21-24	To understand Wavelet and other image transform	Slant, Harr and Wavelet transform	Chap 7 7.4-7.7
25-27	To understand Image Compression	Basic Compression Methods (DCT)	Chap 8 8.1-8.2
28-30	To understand Morphological Image Processing	Erosion, dilation, opening closing, hit-or-miss transformation, some basic morphological algorithms	Chap 9 9.1-9.4, 9.5.1-9.5.7
31-33	To understand Image Segmentation	Point, line and edge detection, thresholding	Chap 10 10.1-10.3
34-36	To understand Representation and description	Boundary following, chain codes, signatures, boundary descriptors, regional descriptors, principal	Chap 11 11.1.1-11.1.2, 11.1.5, 11.2, 11.3.3,11.3.4, 11.4

		components analysis (PCA)	
37 – 42	To understand Object Recognition	Patterns and pattern classes, decision-theoretic methods	Chap 12 12.1-12.8

Evaluation Scheme:

Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
Mid Semester exam	90 Minutes	25%	31/10 11.00 - 12.30PM	Closed Book
Mini Project	----	15%	TBA	Open Book
Programing assignment	—-	15%	TBA	Open Book
Comprehensive Examination	3 Hours	45%	17/12 AN	Closed Book

Note: 40% of the evaluation to be completed by midsem grading.

Chamber Consultation Hour: To be announced in the class.

Notices: Notices concerning the course will be put up on the CMS/Google Classroom website.

Academic Honesty and Integrity Policy:
Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Make-up Policy: Make-up for mid semester exam and comprehensive exam will be granted **only** on genuine grounds of sickness **(to be supported by a medical certificate and not a prescription**). There is NO makeup for other evaluation components.

Instructor-in-Charge

BITS F311