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Signal and Image Processing — Complete Syllabus (Program Elective-2, Option 2)

BTEUP Diploma in Electronics Engineering • 5th Semester • Session 2026-27

Subject 5.4.2 — Program Elective-2, Option 2 (Practicum) • Total 100 Marks • 3 Credits •

L 1 - P 4 • Choose this OR Mechatronics

Note: No marks-distribution table is given for this subject in the PDF, so unit weightages are not shown.

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
5.4.2	Program Elective-2: Signal and Image Processing	Practicum	1 - 4	3	Practical 60	Practical 40 (3 hrs)	100
Signal and Image Processing Total				3	60	40	100

What This Subject Aims To Do

To give foundational and advanced concepts in processing digital signals and images — filtering, sampling, Fourier transforms and convolution — and in image processing: enhancement, restoration, compression, segmentation and feature extraction, with theory and practical implementation using tools such as MATLAB or Python.

Unit-Wise Complete Topic List

Note: no marks-distribution table is given for this subject in the official syllabus, so unit weightages are not shown.

Unit 1 — Basics of Signals and Systems (2 Periods)

Topics: Step, Ramp, Pulse, Impulse, Real, complex and exponentials _ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals. Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non causal, Stable & Unstable

In simple words: The vocabulary of signals and systems: step, ramp, pulse and impulse signals, and how signals and systems are classified.

Unit 2 — Fourier Transform and Laplace Transform (4 Periods)

Topics: Fourier Transform: Fourier series for periodic signals – Fourier Transform – properties. Laplace Transform: Laplace Transforms and properties - convolution and properties

In simple words: The transforms that move a signal between the time domain and the frequency domain: Fourier and Laplace, plus convolution.

Unit 3 — Basics of Image Processing (4 Periods)

Topics: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition, Introduction to image sampling and quantization, Color Image Fundamentals: RGB models

In simple words: How a digital image is captured and represented: sensing, sampling, quantisation, and the RGB colour model.

Unit 4 — Image Enhancement and Restoration (2 Periods)

Topics: Image Enhancement: Spatial Domain: Gray level Transformations-Image negative-contrast stretching - Histogram processing – Basics of Spatial Filtering- Smoothing and Sharpening Spatial filtering. Image Restoration – introduction to degradation model & Noise models

In simple words: Making images clearer: contrast stretching, histogram processing, smoothing and sharpening filters, and how degraded images are restored.

Unit 5 — Image Segmentation and Compression (2 Periods)

Topics: Image Segmentation: Edge detection, Region based segmentation – Region growing – Region splitting and merging. Image Compression: Need for data compression, Huffman, JPEG standard, MPEG

In simple words: Splitting an image into meaningful regions (segmentation) and shrinking image files without losing what matters (JPEG, MPEG, Huffman coding).

Practical Work

- Understand various signal types in the time domain.
- Learn about signal operations such as addition, multiplication, and time-shifting.
- Transform signals from the time domain into the frequency domain.
- Explore critical properties of the Fourier Transform such as linearity, time-shifting, frequency-shifting, scaling, and duality.
- Introduce the Laplace transform as a tool for analyzing continuous-time signals and systems, and verify its properties such as linearity, time-shifting.
- Introduction to Digital Image Processing Environment.
- Understand image as a matrix and perform fundamental operations.
- Break down an image into its RGB components.
- Simulate the process of image capture using virtual sensors.
- Understand human perception of brightness and contrast.
- Improve the visual quality of images by suppressing degradation.
- Understand how reducing intensity levels affects image quality.
- Understand and apply basic pixel intensity transformations.
- Perform segmentation by dividing and combining image regions based on uniformity.
- Demonstrate how compression reduces image size and storage needs.
- Simulate the core steps of JPEG compression.
- Understand basic principles behind video compression.

Reference Books (as listed in the syllabus)

- A.V. Oppenheim, A.S. willsky and S.H. Nawab, Signals and Systems, 2nd Edition, Prentice-Hall of India, 2015
- Rafel C.Gonzalez and Richard E. woods, Digital Image processing, 4th edition, Pearson Inc, 2018
- Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition, Wiley, 2007

follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text.
Please confirm with your own polytechnic for any local changes.

