**Academic Year: 2021 - 22**

**COURSE INFORMATION SHEET**

|  |  |
| --- | --- |
| **Programme:** | **Electronics and Communication Engineering** |
| **Degree:** | **BE** |
| **Course:** | **Digital Image Processing** |
| **Course Code:** | **18EC733** |
| **Semester:** | **VII** |
| **Course Type:** | **Core** |
| **Regulation:** | **VTU 18 Scheme** |
| **Credits:** | **03** |
| **Lecture Hours / Module:** | **08** |
| **Total Number of Lecture Hours:** | **40** |
| **Corresponding Lab Course:** | **-** |
| **Corresponding Lab Course Code:** | **-** |
| **Course Area/Domain:** | **Signal Processing and Communication** |
| **PO Mapped:** | **PO1, PO2, PO3, PO4, PO5, PO7** |
| **PSO Mapped:** | **PSO1, PSO2, PSO3** |

**COURSE CONTENT:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module** | **Details** | **RBT Level** | **CO Mapped** |
| 1 | **Digital Image Fundamentals:** What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition | **L1, L2, L3** | CO1 |
| 2 | **Image Enhancement in the Spatial Domain:** Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters | **L1, L2, L3** | CO2 |
| 3 | **Frequency Domain:** Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. | **L1, L2, L3** | CO3 |
| 4 | **Restoration:** Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. | **L1, L2, L3** | CO4 |
| 5 | **Morphological** **Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing.  **Color Image Processing**: Color Fundamentals, Color Models, Pseudocolor Image Processing. | **L1, L2, L3** | CO5 |

**TEXT BOOKS & REFERENCE BOOKS:**

|  |  |
| --- | --- |
|  | **BOOK TITLE / AUTHORS / PUBLICATION** |
| **T-1.** | Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010. |
| **R-1.** | Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014. |
| **R-2.** | Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004. |
| **R-3** | Image Processing, Analysis, and Machine Vision with Mind Tap by Milan Sonka and Roger Boile, Cenage Publications, 2018 |

T- Text Book. R-Reference Book, AR-Additional Reference

**WEB REFERENCES:**

|  |  |
| --- | --- |
|  | **WEB ADDRESS** |
| **W-1.** | <https://nptel.ac.in/courses/117/105/117105079/> |
| **W-2.** | <https://www.mathworks.com/discovery/digital-image-processing.html> |
| **W-3** | <http://cse19-iiith.vlabs.ac.in/> |

W- Website

**COURSE DESCRIPTION:**

Digital image processing course introduces students to understand about basic fundamental steps in image processing, filtering of image in both spatial and frequency domain, removal of noise in images, including morphological and color image processing of images.

**COURSE PRE-REQUISITES:**

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE NAME** | **COURSE CODE** | **DESCRIPTION** | **Module** |
| Engineering mathematics-III | 18MAT31 | Fourier transforms | Module-3 |
| Signals and systems | 18EC45 | Basic description of signals, Fourier transform, convolution, | Module 1,2 & 4 |
| Digital signal processing | 18EC52 | Sampling and Quantization, DFT, Filters | Module- 1, 3 & 4 |

**COURSE OBJECTIVES:** This course will enable students to:

|  |  |
| --- | --- |
| **Sl. No.** | **DESCRIPTION** |
| **1** | Understand the fundamentals of digital image processing. |
| **2** | Understand the image transform used in digital image processing. |
| **3** | Understand the image enhancement techniques used in digital image processing. |
| **4** | Understand the image restoration techniques and methods used in digital image processing. |
| **5** | Understand the Morphological Operations used in digital image processing |

**COURSE OUTCOMES (COs):** After studying this course, students will be able to:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **DESCRIPTION** | **PO**  **MAPPING** | **PSO MAPPING** |
| **CO1** | Understand the fundamentals of digital image processing. | PO1, PO2 | PSO2, PSO3 |
| **CO2** | Apply image processing techniques in the spatial domain | PO1, PO2, PO3, PO4, PO7 | PSO2, PSO3 |
| **CO3** | Apply image processing techniques in the frequency domain | PO1, PO2 | PSO1, PSO2, PSO3 |
| **CO4** | Conduct independent study on noise restoration models | PO1, PO2, PO3, PO4, PO5, PO7 | PSO1, PSO2, PSO3 |
| **CO5** | Evaluate the methodologies for Morphological operations and understanding the fundamentals of color image processing | PO1, PO2, PO3, PO4, PO5, PO7 | PSO1, PSO2, PSO3 |

**COURSE ARTICULATION MATRIX:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Name** | **Course Code** | | | | | **PO Mapped** | | | | | | | | **PSO Mapped** | | | |
| 18EC34 | Digital System Design | | | | | PO1, PO2, PO3, PO4, PO5, PO7 | | | | | | | | PSO1, PSO2, PSO3 | | | |
| **Course Outcomes** | | **Program Outcomes** | | | | | | | | | | | | | **Program Specific Outcomes** | | |
| **1** | **2** | **3** | **4** | | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| Understand the fundamentals of digital image processing. | | **2** | **2** |  |  | |  |  |  |  |  |  |  |  |  | **3** | 2 |
| Apply image processing techniques in the spatial domain | | **3** | **3** | **3** | **2** | |  |  | **1** |  |  |  |  |  |  | **3** | 2 |
| Apply image processing techniques in the frequency domain | | **2** | **2** |  |  | |  |  |  |  |  |  |  |  | **3** | **3** | 3 |
| Conduct independent study on noise restoration models | | **3** | **3** | **3** | **3** | | **3** |  | **3** |  |  |  |  |  | **3** | **3** | 3 |
| Evaluate the methodologies for Morphological operations and understanding the fundamentals of color image processing | | **3** | **3** | **3** | **3** | | **3** |  | **3** |  |  |  |  |  | **3** | **3** | 3 |

Course Outcome addresses program outcome: 1 - Lightly, 2 – Moderately, 3 - Highly

**GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Gap** | **Action taken** | **Date-Month-**  **Year** | **Resource Person with designation** | **No. of students present** | **Relevance to POs, PSOs** |
| 1 | Implementation of DIP algorithms in System of Chip (SOC) | Workshop on Artix-7 FPGA | 09-5-22 | Mr. Vardhana M | 30 | PO-1,2,3,5,9,12 |

**PROPOSED ACTIONS:** TOPICS BEYOND SYLLABUS / ASSIGNMENT / INDUSTRY VISIT / GUEST LECTURER / NPTEL ETC

**TOPICS BEYOND SYLLABUS / ADVANCED TOPICS / DESIGN:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Topics** | **CO** | **PO** | **PSO** | **METHODOLOGY** |
| 1 | Segmentation, Representation and Description | 5 | PO-1,2,3,5 | PSO2, PSO3 | Lab Practice |

**Method** may be: Theory subjects, Quizzes, Mini Project Work, Lab practices, Seminars assignments, Participation in various conferences, Industrial Visits, workshops and technical Talk.

**DELIVERY / INSTRUCTIONAL METHODOLOGIES:**

|  |  |  |
| --- | --- | --- |
| ✔ CHALK & TALK | ✔ ASSIGNMENTS | ☐ WEB RESOURCES |
| ✔ LCD / SMART BOARDS | ☐ SEMINARS | ☐ OTHERS |

**ASSESSMENT METHODOLOGIES – DIRECT**

* INTERNAL ASSESSMENT
* UNIVERSITY EXAMINATION

**ASSESSMENT METHODOLOGIES – INDIRECT**

* ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)

**COURSE RESULTS:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NO. OF STUDENTS** | | **S** | **A** | **B** | **C** | **D** | **E** | **F** | **PASS %** | **PI** |
| ATTENDED | PASSED |
|  |  |  |  |  |  |  |  |  |  |  |

**PI = (S\*10 + A\*9 + B\*8 + C\*7 + D\*6 + E\*4 + F\*1)/(10 \* total number of students attended)**

**CO Attainment Level (In percentage)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| Internal Assessment |  |  |  |  |  |
| University Results (PI) (Same for all COs) |  |  |  |  |  |
| Student Feedback on COs |  |  |  |  |  |
| Overall Attainment Level |  |  |  |  |  |

**Overall Attainment Level = 0.4 \* Internal Assessment + 0.4 \* University Result + 0.2 \* Student Feedback on COs**