<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P-Credits</th>
<th>Year of Introduction</th>
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<tbody>
<tr>
<td>CS463</td>
<td>DIGITAL IMAGE PROCESSING</td>
<td>3-0-0-3</td>
<td>2016</td>
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**Course Objectives:**
- To introduce and discuss the fundamental concepts and applications of Digital Image Processing.
- To discuss various basic operations in Digital Image Processing.
- To know various transform domains

**Syllabus:**
Introduction on digital image processing fundamentals; Image Transforms; Spatial and frequency domain filtering; Image segmentation; Morphological Image processing; Representation and Description.

**Expected Outcome**
The Students will be able to:
- i. compare different methods for image acquisition, storage and representation in digital devices and computers
- ii. appreciate role of image transforms in representing, highlighting, and modifying image features
- iii. interpret the mathematical principles in digital image enhancement and apply them in spatial domain and frequency domain
- iv. apply various methods for segmenting image and identifying image components
- v. summarise different reshaping operations on the image and their practical applications
- vi. identify image representation techniques that enable encoding and decoding images

**Text Books:**

**References:**

**COURSE PLAN**

<table>
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<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>End Sem. Exam Marks</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; Pixels; coordinate conventions; Imaging Geometry; Spatial Domain; Frequency Domain; sampling and quantization; Basic relationship between pixels; Applications of Image Processing.</td>
<td>6</td>
<td>15%</td>
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<tr>
<td>II</td>
<td>Image transforms and its properties – Unitary transform; Discrete Fourier Transform; Discrete Cosine Transform; Walsh Transform; Hadamard Transform;</td>
<td>7</td>
<td>15%</td>
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<td>III</td>
<td>Image Enhancement in spatial domain Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Gray Level Slicing; Bit Plane Slicing; Histogram Processing–Equalization; Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Gaussian Filters; Spatial Filtering; Sharpening: Ideal High Pass Filter; Gaussian High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.</td>
<td>8</td>
<td>15%</td>
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<tr>
<td>IV</td>
<td>Image Enhancement in Frequency Domain Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters: Ideal Low Pass Filter; Gaussian Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Gaussian High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.</td>
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<td>15%</td>
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<td>V</td>
<td>Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators; Line Detection, Corner Detection.</td>
<td>8</td>
<td>20%</td>
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<tr>
<td>VI</td>
<td>Morphological Operations Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing; Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.</td>
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**END SEMESTER EXAM**

**Question Paper Pattern (End semester exam)**

1. There will be **FOUR** parts in the question paper – A, B, C, D
2. Part A
   a. **Total marks : 40**
   b. **TEN** questions, each have **4 marks**, covering all the SIX modules (**THREE** questions from **modules I & II**; **THREE** questions from **modules III & IV**; **FOUR** questions from **modules V & VI**). **All the TEN** questions have to be answered.
3. Part B  
   a. Total marks : 18  
   b. **THREE** questions, each having *9 marks*. One question is from module I; one question is from module II; one question *uniformly* covers modules I & II.  
   c. *Any TWO* questions have to be answered.  
   d. Each question can have *maximum THREE* subparts.  

4. Part C  
   a. Total marks : 18  
   b. **THREE** questions, each having *9 marks*. One question is from module III; one question is from module IV; one question *uniformly* covers modules III & IV.  
   c. *Any TWO* questions have to be answered.  
   d. Each question can have *maximum THREE* subparts.  

5. Part D  
   a. Total marks : 24  
   b. **THREE** questions, each having *12 marks*. One question is from module V; one question is from module VI; one question *uniformly* covers modules V & VI.  
   c. *Any TWO* questions have to be answered.  
   d. Each question can have *maximum THREE* subparts.  

6. There will be *AT LEAST 60%* analytical/numerical questions in all possible combinations of question choices.