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| **School: SET** | **Batch : 2019-2023** |
| **Program: B.Tech** | **Current Academic Year: 2019-20** |
| **Branch: ALL** | **Semester: VII** |
| **1** | **Course Code** | **CSA401** | **Course Name: Computer Vision** |
| **2** | **Course Title** | **Computer Vision** |
| **3** | **Credits** | **3** |
| **4** | **Contact Hours** **(L-T-P)** | **3-0-0** |
|  | **Course Status** | **Program Elective** |
| 5 | Course Objective | 1. To implement fundamental image processing techniques required for computer vision
2. To develop applications using computer vision techniques
 |
| 6 | Course Outcomes | Students will be able to have thorough Understanding of:CO-1 Define theFundamentals of Computer Vision and Computer  Graphics and relate them with real world applications CO-2 Explain Image formation models and Foundations for  Mathematical basis for various Projection SystemsCO- 3 Apply Image processing techniques such as Segmentation  and Edge Detection for real time and real-world applications. CO- 4 Analyze various feature extraction techniques for different  problem domain.CO-5 Evaluate Pattern Recognition Using Clustering,  Classification, Supervised Learning and Unsupervised  Learning TechniquesCO-6 Build computer vision applications for real world  Applications. |
| 7 | Course Description | In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.  |
| 8 | Outline syllabus | CO Mapping |
|  | **Unit 1** | **Introduction to Computer Vision** |  |
| A | Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level | CO1 |
| B | Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis | CO1 |
| C | Face detection, Face recognition, Eigen faces, Active appearance and 3D shape models of faces, Surveillance, foreground-background separation, vehicle vision system: locating roadway, road markings, identifying road signs, locating pedestrians | CO1 |
|  | **Unit 2** | **Image Formation Models** |  |
| A | Monocular imaging system , Radiosity: The ‘Physics’ of Image Formation, Radiance, Irradiance, Brightness, color etc,  | CO2 |
| B | Orthographic & Perspective Projection ,Camera model and Camera calibration, Binocular imaging systems  | CO2 |
| C | Multiple views geometry, Structure determination, shape from shading, Weak perspective projection and orthographic projection, Concept of image coordinate system and camera coordinate system; | CO2 |
|  | **Unit 3** | **Image Processing**  |  |
| A | Image preprocessing: The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Discrete Cosine Transform (DCT) | CO3, CO6 |
| B | Wavelet Transforms in One Dimension-The Discrete Wavelet Transform (DWT) and The Continuous Wavelet Transform. Wavelet Decomposition, | CO3, CO6 |
| C | Orthogonal, Euclidean, Affine, Projective, etc; Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing. | CO3, CO6 |
|  | **Unit 4** | **Image Processing Operations** |  |
| A | Image Filtering (spatial domain), Mask-based (e.g., correlation, convolution), Smoothing (e.g., Gaussian), Sharpening (e.g., gradient) | CO4 |
| B | Segmentation : Edge-based (e.g., voting, optimization, perceptual grouping), Pixel-based (e.g., clustering) | CO4 |
| C | Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation | CO4 |
|  | **Unit 5** | **Feature Extraction** |  |
| A | Edge detection: Canny, Laplacian of Gaussian; Line detectors (Hough Transform) | CO5, CO6 |
| B | Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH | CO5, CO6 |
| C | Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters  | CO5, CO6 |
|  | Mode of examination | Theory |  |
|  | Weightage Distribution | CA | MTE | ETE |  |
| 30% | 20% | 50% |  |
|  | **Text book/s\*** | 1. Milan Sonka, Vaclav Hlavac, Roger Boyle, ”Digital Image Processing and Computer Vision”Cengage Learning, 1st Edition, 20082. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill. |  |
|  | **Reference Books** | 1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.  |  |

CO and PO Mapping

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| S. No. | Course Outcome | Program Outcomes (PO) & Program Specific Outcomes (PSO) |
| 1. | CO-1 Define theFundamentals of Computer Vision and Computer Graphics and relate them with real world applications | PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2,PSO3 |
| 2. |  CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems  | PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2,PSO3 |
| 3. | CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications. | PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2,PSO3 |
| 4. |  CO- 4 Analyze various feature extraction techniques for different problem domain. | PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2,PSO3 |
| 5. | CO-5 Evaluate Pattern Recognition Using Clustering,  Classification, Supervised Learning and Unsupervised Learning Techniques | PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2,PSO3 |
| 6. |  CO-6 Build computer vision applications for real world  applications. | PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PSO1,PSO2,PSO3 |

**PO and PSO mapping with level of strength for Course Name** Computer Vision **(Course Code** CSA-401**)**

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| **Subject** | **PO’s / PSO’s** | **PO****1** | **PO****2** | **PO****3** | **PO****4** | **PO****5** | **PO****6** | **PO****7** | **PO****8** | **PO****9** | **PO****10** | **PO****11** | **PO****12** | **PSO****1** | **PSO****2** | **PSO****3** |
| Computer VisionCSA-401 | CO1 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 3 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 |  1 | 2 | 1 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 3 | 3 |

**Average of non-zeros entry in following table (should be auto calculated).**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **PO 1** | **PO2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **CSA-401** | **Computer Vision** | 3.00 | 3.00 | 3.00 | 3.00 | 1.83 | 1.67 | 1.33 | 1.00 | 1.33 | 2.00 | 1.00 | 3.00 | 2.67 | 3.00 | 2.00 |

**Total- 32.83**

**Strength of Correlation**

**1.** Addressed to **Slight (Low=1) extent 2.** Addressed to **Moderate (Medium=2) extent**

**3.** Addressed to **Substantial (High=3) extent**