

|                              |                                                                                                                          |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Branch Name:</b>          | Signal Processing and Communication                                                                                      |
| <b>Program Code:</b>         | ET214                                                                                                                    |
| <b>Course Name:</b>          | Advanced Computer Vision                                                                                                 |
| <b>Course Code:</b>          | 2ET2140403T                                                                                                              |
| <b>Pre-requisite Subject</b> | A good knowledge of basic image processing, linear algebra, vector calculus, Multidimensional data handling is required. |

**Course Objective:**

1. To study the properties of the three-dimensional world from digital images.
2. To study the Problems in this field include identifying the 3D shape of an environment, determining how things are moving, and recognizing familiar people and objects, all through analysis of images and video.
3. To study the introduction to computer vision, including such topics as feature detection, motion estimation, image mosaics, 3D shape reconstruction, and object recognition.

**Teaching and Examination Scheme:**

| Credit | Teaching Scheme<br>Hours per week |   |   |       | Evaluation Scheme (Marks) |      |      |      |                   |      |      |      |                  |
|--------|-----------------------------------|---|---|-------|---------------------------|------|------|------|-------------------|------|------|------|------------------|
|        |                                   |   |   |       | Theory (Marks)            |      |      |      | Practical (Marks) |      |      |      | Total<br>(Marks) |
|        | L                                 | T | P | Total | SEE                       |      | CCA  |      | SEE               |      | CCA  |      |                  |
|        |                                   |   |   |       | Min.                      | Max. | Min. | Max. | Min.              | Max. | Min. | Max. |                  |
| 3      | 3                                 | - | - | 3     | 24                        | 60   | 16   | 40   | -                 | -    | -    | -    | 100              |

**Course Contents:**

| Sr.<br>No | Topic                                                                                                                                                                                      | Total<br>Hours | Weight<br>(%) |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|
| 1         | <b>Introduction:</b><br>What is computer vision, A brief history of computer vision                                                                                                        | 02             | 05            |
| 2         | <b>Feature-based alignment:</b><br>2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration                                                                     | 05             | 15            |
| 3         | <b>Structure from motion:</b><br>Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion                                        | 05             | 17            |
| 4         | <b>Dense motion estimation:</b><br>Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion                                                           | 05             | 17            |
| 5         | <b>Image stitching:</b><br>Motion models, Global alignment, Compositing,                                                                                                                   | 07             | 15            |
| 6         | <b>Computational photography:</b><br>Photometric calibration, High dynamic range imaging, Super-resolution and blur removal, Image matting and compositing, Texture analysis and synthesis | 07             | 16            |
| 7         | <b>Recognition:</b><br>Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test set                 | 08             | 15            |

**List of Text Book:**

1. Computer Vision: Algorithms and Applications - Richard Szeliski, Springer.

**List of Reference Books:**

1. Computer Vision: A Modern Approach - D. A. Forsyth, J. Ponce, Pearson Education.
2. Multiple View Geometry in Computer Vision - Richard Hartley and Andrew Zisserman, Cambridge University Press.

**Course Learning Outcomes (CLO): On completion of this course, the students will be able to:**

| CLO  | Description                                                                                       | Bloom's Taxonomy Level           |
|------|---------------------------------------------------------------------------------------------------|----------------------------------|
| CLO1 | To identify, formulate and solve computer vision based engineering problems.                      | 1 Remembering<br>2 Understanding |
| CLO2 | To understand complex vision geometry.                                                            | 2 Understanding                  |
| CLO3 | To develop highly complex computer vision based system according to their choice of applications. | 2 Understanding                  |
| CLO4 | To analyze and compare already existing design of vision systems.                                 | 2 Understanding<br>3 Applying    |
| CLO5 | To able to compare the various existing systems                                                   | 2 Understanding<br>4 Analyze     |
| CLO6 | To understand Computational photography and Recognition:                                          | 2 Understanding<br>6 Create      |

**Mapping of CLOs with POs & PSOs**

| Course Learning Outcomes | Program Outcomes (POs) |     |     |     |     |     |     |     |     |      |      |      | Program Specific Outcomes(PSOs) |      |      |      |
|--------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|---------------------------------|------|------|------|
|                          | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1                            | PSO2 | PSO3 | PSO4 |
| CLO1                     |                        |     |     |     | L   | M   |     |     |     |      |      | H    | H                               | M    | L    |      |
| CLO2                     |                        | H   | M   | M   | L   |     |     |     |     | L    |      | H    |                                 | M    | L    |      |
| CLO3                     |                        | M   | H   |     | L   |     |     |     |     |      |      |      |                                 | H    |      | L    |
| CLO4                     |                        | M   | H   |     | L   |     |     | L   |     |      |      |      | L                               |      | M    | H    |
| CLO5                     | H                      | M   | H   |     | L   |     |     |     | L   |      |      | H    | L                               |      | M    | H    |
| CLO6                     | H                      | M   | H   |     | L   |     |     |     |     |      |      | M    | L                               |      | M    | H    |

H: High, M: Medium, L: Low