



# National University of Sciences and Technology

## Course Description

Course Title	Course Code	Credit Hours
Image Processing and Computer Vision for Fluid Mechanics	ME-878	3 – 0

### Textbook:

- "Digital Image Processing for Flow Visualization" by Markus Abel and Wolfgang Merzkirch

### Reference Books:

- "Flow Visualization: Techniques and Examples" by Alex Liberzon
- "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods
- "Computer Vision: Algorithms and Applications" by Richard Szeliski

### Course Objective:

- The course will cover the fundamental concepts and techniques of image processing and computer vision as they apply to fluid mechanics.

### Course Outline:

- Introduction to Image Processing and Computer Vision
- Image acquisition and processing pipeline
- Image representation and color spaces
- Basic image manipulation techniques
- Image Pre-processing and Segmentation
- Noise reduction and image enhancement
- Thresholding and region growing techniques
- Edge detection and morphology operations
- Feature Extraction and Object Tracking
- Feature detection and matching algorithms
- Optical flow and motion estimation
- Object tracking and Kalman filtering
- Image-Based Flow Visualization
- Techniques for visualizing fluid flow using image data
- Particle image velocimetry (PIV) and particle tracking velocimetry (PTV)
- Flow field reconstruction and analysis
- Applications of Image Processing and Computer Vision in Fluid Mechanics
- Case studies and examples of image-based flow analysis
- Hands-on project applying image processing and computer vision techniques to a fluid mechanics problem

## ASSESSMENTS

Description	Percentage Weightage (%)
Assignments	05-10%
Quizzes	10-15%
Mid Semester Exams	30-40%
End Semester Exam	40-50%