



**Department of Computer Science and Engineering**

**Lesson Plan:**

**Course Title: Computer Graphics & Image Processing**

**Course Code: CSE 455**

**Credits: 3**

**Class Hours/Week: 3**

**Course Type: Core**

**Pre-requisite: SP**

**CIE Marks: 60**

**SEE Marks: 40**

**Session: FALL 2024**

**Instructor : Salman Farsi, Lecturer, DCSE, PU**

**Class schedule: Section C: Monday(8:30am -9:45am)**

**Wednesday(8.30am-9:45am)**

**Section B: Sunday (2.30pm-3.45pm)**

**Monday(12.15pm-1.30pm)**

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**Course Rationale:**

Computer graphics concentrates on the fundamentals of computer graphics and addresses the knowledge and skill in computer graphics development which are essential for computing professionals. Image processing, on the other hand emphasizes on general principles of image processing and its application.

**Course Objectives:**

The objectives of this course are:

1. To develop a theoretical foundation of fundamental computer Graphics & Digital Image Processing concepts.
2. To learn basic algorithms for computer graphics and image processing.
3. To understand and imply various filters, Point processing, and Arithmetic operations in image processing.
4. To understand different applications of graphics and image processing.

### Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

<b>CO1</b>	<b>Explain (C2)</b> the fundamental concepts of computer graphics and image processing.
<b>CO2</b>	<b>Demonstrate (C3)</b> the scan conversion algorithms for drawing various types of geometric shapes.
<b>CO3</b>	<b>Illustrate (C3)</b> the ideas of 2D and 3D transformation and clipping techniques.
<b>CO4</b>	<b>Use (C3)</b> different types of image processing techniques for transformation, filtering, smoothing and enhancement.
<b>CO5</b>	<b>Solve (C3)</b> different image compression algorithms, segmentation and feature extraction techniques.

### Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	√											
<b>CO2</b>	√	√										
<b>CO3</b>	√	√										
<b>CO4</b>	√	√										
<b>CO5</b>	√	√										

### Course Description:

SL No.	Course Contents	COs
1.	<b>Fundamental Concepts:</b> Image representation, color model, pixel, rasterization, lookup table, image types, graphical hardware, image fundamentals, sampling, quantization, mathematical tools.	CO1
2.	<b>Scan conversion:</b> Scan conversion algorithms for point, line, circle, ellipse, rectangle, Region filling, scan converting character, anti-aliasing	CO2
3.	<b>2D and 3D Transformation, viewing, clipping:</b> Geometric transformation, translation, rotation, scaling, mirror reflection, co-ordinate transformation, composite transformation, instance transformation, viewport mapping, shape	CO3
4.	<b>Image processing:</b> Fundamental concepts, color model conversion, smoothing, filtering, sharpening, fourier transformation, image enhancement, image	CO1, CO4
5.	<b>Compression and segmentation:</b> Huffman coding, Arithmetic coding, LZW coding, Bit-plane coding, Wavelet coding, watermarking, thresholding,	CO5

**Text Books, Reference Books and Other Resources:**

1. **Computer Graphics: Zhigang Xiang and Roy Plastock**
2. Digital Image Processing: Rafael C. Gonzalez, Richard E. Woods
3. Computer Graphics: Principles and Practice: James D Foley, Andries Van Dan

**Mapping Course Outcomes with the Teaching-Learning and Assessment Strategy:**

<b>COs</b>	<b>Corresponding POs</b>	<b>Bloom's Taxonomy Domain/Level</b> <i>(C: Cognitive, P: Psychomotor A: Affective)</i>	<b>Delivery Methods and Activities</b>	<b>Assessment Tools</b>
<b>CO1</b>	PO1	C2	Lecture, Slide	Class Test, Assignment, Midterm, Final
<b>CO2</b>	PO1, PO2	C3	Lecture, Slide	Class Test, Assignment, Midterm, Final
<b>CO3</b>	PO1, PO2	C3	Lecture, Slide	Class Test, Assignment, Midterm, Final
<b>CO4</b>	PO1, PO2	C3	Lecture, Slide	Class Test, Assignment, Midterm, Final
<b>CO5</b>	PO1, PO2	C3	Lecture, Slide	Class Test, Assignment, Midterm, Final

**Marks distribution**

<b>Description</b>	<b>Marks</b>
Class Attendance/ Participation	10
Class Test	20
Assignments	10
Midterm	20
Final Exam	40

**Lecture schedule:**

<b>Class</b>	<b>Date</b>	<b>Topic</b>	<b>Teaching Strategy</b>	<b>CO</b>	<b>Assessment Strategy</b>
<b>1</b>		<b>Computer Graphics:</b> Introduction, Raster and Vector Graphics	Lecture notes, Slides, slides, problem solve	<b>CO1</b>	Midterm, Final
<b>2</b>		The RGB and CMY color model, Direct Coding, Lookup Table	Lecture notes, Slides, problem solve	<b>CO1</b>	Midterm, Final
<b>3</b>		Scan-Converting a Point, Scan-Converting a Line	Lecture notes, Slides, problem solve	<b>CO2</b>	Class Test 1, Midterm, Final
<b>4</b>		Scan-Converting a Circle, Scan-Converting a Rectangle	Lecture notes, Slides, problem solve	<b>CO2</b>	Class Test 1, Midterm, Final
<b>5</b>		Scan-converting a character, Region Filling, Anti-Aliasing	Lecture notes, Slides, problem solve	<b>CO2</b>	Class Test 1, Midterm, Final
<b>6</b>		<b>Class Test – 1</b>		<b>CO2</b>	
<b>7</b>		Geometric Transformations, Coordinate Transformations, Composite Transformations, Instance Transformations	Lecture notes, Slides, problem solve	<b>CO3</b>	Midterm, Final
<b>8</b>		Window-to-Viewport Mapping, Point Clipping, Line Clipping, Polygon Clipping	Lecture notes, Slides, problem solve	<b>CO3</b>	Midterm, Final
<b>9</b>		<b>Result publication of CT-1;</b> Polygon Meshes, Parametric Cubic Curves,	Lecture notes, Slides, problem solve	<b>CO3</b>	Midterm, Final
<b>10</b>		Hermit Curves, Bezier Curves	Lecture notes, Slides, problem solve	<b>CO3</b>	Midterm, Final
<b>11</b>		<b>Image Processing:</b> Fundamental Steps in DIP	Lecture notes, Slides, problem solve	<b>CO4</b>	CT-2, Final
<b>12</b>		Components of an Image Processing System, Image model,	Lecture notes, Slides, problem solve	<b>CO4</b>	Class Test 2, Midterm, Final

13		Image Sampling and Quantization,	Lecture notes, Slides, problem solve	CO1	Class Test 2, Midterm, Final
14		<b>Midterm</b>		CO1, CO3	
15		Relationships between pixels, Some Basic Intensity Transformation Function	Lecture notes, Slides, problem solve	CO1	Final
16		<b>Result publication of Midterm;</b> Image Smoothing using Frequency Domain Filters	Lecture notes, Slides, problem solve	CO4	Final
17		Discrete Fourier Transform, Discrete Cosine Transform,	Lecture notes, Slides, problem solve	CO4	Assignment, Final
18		<b>Class Test - 2</b>		CO4	
19		Haar Transform, Hadamard Transform	Lecture notes, Slides, problem solve	CO4	Final
20		Define gray and binary image, Fundamental of binary image analysis	Lecture notes, Slides, problem solve	CO1, CO4	Final
21		<b>Result publication of CT-2;</b> Convert a gray scale image to a binary image: Thresholding	Lecture notes, Slides, problem solve	CO4	Final
22		Image Sharpening using Frequency Domain Filters Filtering image: Gaussian filter, Gabor filter	Lecture notes, Slides, problem solve	CO4	Assignment, Final
23		<b>Assigning Complex engineering problem;</b> Image Compression: Huffman Coding	Lecture notes, Slides, problem solve	CO5	Class Test 3, Final
24		Image Compression: Arithmetic Coding	Lecture notes, Slides, problem solve	CO5	Class Test 3, Final
25		LZW Coding, Bit plane slicing	Lecture notes, Slides, problem solve	CO5	Class Test 3, Final
26		<b>Class Test – 3 + Review and Problem solving</b>		CO5	