هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

# Course Specifications

| | |
|---|---|
| **Course Title:** | Digital Image Processing |
| **Course Code:** | 503576-3 |
| **Program:** | Bachelor in Computer Engineering |
| **Department:** | Department of Computer Engineering |
| **College:** | College of Computers and Information Technology |
| **Institution:** | Taif University |

## Table of Contents

## A. Course Identification

| |
|---|
| **1. Credit hours:3** |
| **2. Course type**<br>**a.** University ☐ College ☐ Department ■ Others ☐<br>**b.** Required ☐ Elective ■ |
| **3. Level/year at which this course is offered: 9/5** |
| **4. Pre-requisites for this course** (if any)**:**<br>Digital Signal Processing (503474-3) |
| **5. Co-requisites for this course** (if any)**:**<br>Non |

**6. Mode of Instruction** (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | **Traditional classroom** | 3 | 100% |
| 2 | **Blended** | | |
| 3 | **E-learning** | | |
| 4 | **Distance learning** | | |
| 5 | **Other** | | |

**7. Contact Hours** (based on academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1 | **Lecture** | 45 |
| 2 | **Laboratory/Studio** | |
| 3 | **Tutorial** | |
| 4 | **Others** (specify) | |
| | **Total** | 45 |

## B. Course Objectives and Learning Outcomes

**1. Course Description**

This course offers an introduction to the theory of multidimensional signal processing and digital image processing. Topics include; human visual system, image acquisition and display, image sampling and quantization, color representations, image filtering, image transforms; FFT and DCT, image enhancement, morphological image processing, image restoration, image denoising, image segmentation, and image compression.

**2. Course Main Objective**

1. Understand the fundamental concepts of 2D signals and systems.
2. Present and describe common image processing operations in spatial domain.
3. Present and describe common image processing operations using different transform domains.
4. Explain the image compression and decompression.

### 3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge and Understanding** | |
| 1.1 | Recognize the fundamental concepts of a digital image processing system | K1 |
| 1.2 | Perform digital image processing operations in spatial domain including point operations, histogram processing, image filtering, edge detection, image segmentation and restoration, and morphological operations. | K1 |
| **2** | **Skills :** | |
| 2.1 | Perform digital image processing operations in transform domain using Fourier transform. | S1 |
| 2.2 | Perform image processing operations on color images. | S2 |
| 2.3 | Recognize and perform image compression algorithms. | S2 |
| **3** | **Values: NON** | |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | The digital image processing field: Introduction, definitions, and applications, Image fundamentals: Models, sampling, quantization, and basic operations | 3 |
| 2 | Image Enhancement: Point processing, intensity transformations, contract stretching. | 3 |
| 3 | Histogram processing: histogram equalization and specification. | 4 |
| 4 | Spatial domain filtering: 2-D convolution, Smoothing filters, Median filter | 5 |
| 5 | Spatial domain filtering: Gradient and Laplacian, edge detection, sharpening filters | 5 |
| 6 | Image segmentation: Global and adaptive thresholding, Morphological image processing | 5 |
| 7 | 1D and 2D Discrete Fourier Transform, DFT, Properties of DFT | 5 |
| 8 | Frequency domain processing: Low & high pass Filtering. Image restoration, noise models | 5 |
| 9 | Color and Multichannel image processing: Color fundamentals, models, transformation, and enhancement | 5 |
| 10 | Image compression fundamentals | 5 |
| **Total** | | 45 |

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge and Understanding** | | |
| 1.1 | Recognize the fundamental concepts of a digital image processing system. | Lecture<br>Discussion<br>Problem Solving | Written Exams<br>Quizzes<br>Assignments |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| 1.2 | Perform digital image processing operations in spatial domain including point operations, histogram processing, image filtering, edge detection, image segmentation and restoration, and morphological operations. | Lecture<br>Discussion<br>Problem Solving | Written Exams<br>Quizzes<br>Assignments |
| **2.0** | **Skills** | | |
| 2.1 | Perform digital image processing operations in transform domain using Fourier transform. | Lecture<br>Discussion<br>Problem Solving | Written Exams<br>Quizzes<br>Assignments |
| 2.2 | Perform image processing operations on color images. | Lecture<br>Discussion<br>Problem Solving | Written Exams<br>Quizzes<br>Assignments |
| 2.3 | Recognize and perform image compression algorithms. | Lecture<br>Discussion<br>Problem Solving | Written Exams<br>Quizzes<br>Assignments |
| **3.0** | **Values: NON** | | |

### 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| **1** | Assignments | Continues | 5% |
| **2** | Midterm Exam | 7 | 20% |
| **3** | Project | 8 | 15% |
| **4** | Quizzes | Continues | 10% |
| **5** | Final Exam | 16 | 50% |
| **6** | | | |

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:**
Teaching staff provide at least 6 office hours for students to help them in the course as well as in any other academic issues.

## F. Learning Resources and Facilities

### 1.Learning Resources

| | |
|---|---|
| **Required Textbooks** | R. Gonzalez and R. Woods, Digital Image Processing, third edition, Prentice Hall, 2008. |
| **Essential References Materials** | C. Solomon and T. Breckon, Fundamentals of Digital Image processing: A Practical Approach with Examples in MATLAB, third edition, John Wiley & sons inc and Lab Manual, 2011. |

| | |
|---|---|
| **Electronic Materials** | |
| **Other Learning Materials** | |

## 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | Traditional Classrooms, Laboratories |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | Data show |
| **Other Resources** (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | |

## G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Effectiveness of teaching and assessment | Students | Indirect (Survey) |
| Extent of achievement of course learning outcomes | Students | Indirect (Survey) |
| Extent of achievement of course learning outcomes | Faculty | Course Report |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

| | |
|---|---|
| **Council / Committee** | Computer Engineering Council / Curriculum Committee |
| **Reference No.** | |
| **Date** | |

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