SYLLABUS

1. Course name: INDUSTRIAL IMAGE PROCESSING

2. Course code: IMPR322046

3. Credits: 2 (2/0/4)

Duration: 15 weeks (30h main course and 60h self-study)

4. Instructors:

1- Assco. Prof. PhD. Nguyen Thanh Hai

3- PhD. Le My Ha

4- PhD. Nguyen Van Thai

5. Course conditions

Prerequisites: Programming Language

Corequisites: Data acquisition system and SCADA

6. Course description

This course introduces fundamental knowledge of image processing. The concept includes basic operation on image domain and its applications. These issues about image fitering, image enhancement, segmentation and edge detection will be discussed.

7. Course Goals

Goals	Goal description *(This course provides students:)*	ELOs
G1	The fundamental of image processing and image presentation.	1.1, 1.2
G2	Image filtering, image enhancement, image transformation, segmentation and edge detection.	2.2, 1.3
G3	Reading and using English material.	2.1
G4	Team work.	2.5, 3.1

* Note: High: H; Medium: M; Low: L

8. Course Learning Outcomes (CLOs)

CLOs		Description *(After completing this course, students can have:)*	Outcome
G1	G1.1	Have ability to present image processing applications in industrial fields and human life.	1.1, 1.2
	G1.2	Have ability to present the image acquisition.	1.1, 1.2
	G1.3	Have ability to present an image in both space and frequency domain.	1.1, 1.2
G2	G2.1	Have ability to implement image enhancement.	2.2
	G2.2	Have ability to implement image filtering.	2.2

	G2.3	Have ability to implement image transformation.	2.2, 1.3
	G2.4	Have ability to implement image segmentation and edge detection.	2.2
G3	G3.1	Have ability to read English material.	2.1
	G3.2	Have ability to present a solution by English.	2.1
G4	G4.1	Have ability to implement a part of project in team work.	2.5, 3.1

9. Study materials

- Textbooks:

[1] Nguyen Thanh Hai, *Giao trinh xu ly anh*, Dai hoc Su pham Ky thuat TP.HCM, 2014.

- References:

[1] Nguyễn Thanh Hải, Ngo Quoc Cuong *Giáo trình Xử Lý Ảnh*, NXB Dai Hoc Quoc Gia, 2015.

[2] Nguyen Quang Hoan, *Xu ly anh,* Hoc vien Cong nghe Buu Chinh vien thong, 2006.

[3] Do Nang Toan – Pham Viet Binh, *Xu ly anh,* Dai hoc Thai Nguyen, 2007.

[4] R.E. Gonzalez, R.C.Woods, and S.L.Eddins, Digital Image Processing using Matlab, Second Edition,Gatesmark Publishing, 2009.

10. Student Assessments

- Grading points: 10

- Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Exam01	- Fundamental of an image. - Fundamental of image processing methods.	week 2, 5, 6	Quiz	G1.1, G1.2, G1.3	10
Exam02	- Image enhancement. - Histogram equalization.	week 11	Individual paper assessment in class	G1.3, G2.1, G2.2, G3.1 G3.2,	20
Exam03	- Image transformation and Image filtering. - Report and Matlab coding.	week 15	Presentation	G2.3-G2.4, G4.1-G4.2	20
Final exam					**50**
Final Exam	- Segmentation and edge detection.		Individual paper assessment	G1.2-G1.3, G2.3, G2.4, G3.1,G3.2	

11. Course details:

Weeks	Contents	CLOs
1	*Chapter 1: <IMAGE PROCESSING INTRODUCTION> (3/0/6)*	

	A/ **Contents and teaching methods**: *(3)*
	Contents:
	  1.1 Image processing introduction.
	  1.2 Image processing applications.
	Teaching methods:
	  + Theoretical lectures.
	  + Questions.
		G1.1
		G4.2	

	B/ **Self-study contents**: *(6)* + Study about the new applied fields of image processing.	G1.1 G3.1	
2	*Chapter 2: <IMAGE PROCESSING>* *(6/0/12)*		

	A/ **Contents and teaching methods**: *(3)*
	Contents:
	  2.1 Image acquisition principle.
	  2.2 Basic image category.
	  2.3 Basic image parameter.
	Teaching methods:
	  + Theoretical lectures.
	  + Questions.
		G1.2
		G3.1	

	B/ **Self-study contents**: *(6)* + The basic standards of image compression. + Exercises.	G1.1 G1.2	
3	*Chapter 2: <IMAGE PROCESSING (cont.)>* *(6/0/12)*		

	A/ **Contents and teaching methods**:*(3)*
	Contents:
	  2.4 Matlab instruction for image processing.
	  2.5 Image import/export.
	  2.6 Image visulization.
	Teaching methods:
	  + Theoretical lectures.
	  + Questions.
		G1.1
		G1.2	

	B/ **Self- study contents**: *(6)* + Understand the commands of MATLAB. + Exercises.	G1.1 G1.2	
4	*Chapter 3: <IMAGE IN FREQUENCY DOMAIN>* *(6/0/12)*		

	A/ **Contents and teaching methods**: *(3)*
	Contents:
	  3.1 Signals in the frequency domain.
	  3.2 Fourier transformation methods.
	Teaching methods:
	  + Theoretical lectures.
		G1.3
		G3.1	

	+ Questions.	
	B/ Self- study contents: *(6)* + The Fourier transformation for the signals in the time domain. + Exercises.	G1.3 G3.1
5	*Chapter 3:* **<IMAGE IN FREQUENCY DOMAIN (cont.)>** *(6/0/12)*	
	A/ Contents and teaching methods: *(3)* **Contents:** 3.3 Image in frequence domain. 3.4 Fourier transformation and Inverse Fourier transformation. 3.5 Display an image in frequency domain. **Teaching methods**: + Theoretical lectures. + Questions.	G1.3 G3.1 G4.2
	B/ Self- study contents: *(6)* + Fourier transformation. + Exercises.	G1.3 G3.1 G4.2
6	*Chapter 4:* **<IMAGE ENHANCEMENT>** *(6/0/12)*	
	A/ Contents and teaching methods: *(3)* **Contents:** 4.1 Pixel based image enhancement. **Teaching methods**: + Questions and answers. + Guide to do exercises.	G2.1 G2.2
	B/ Self- study contents: *(6)* + The fundemental transformations.	G2.1 G2.2
7	*Chapter 4:* **<IMAGE ENHANCEMENT (cont.)>** *(6/0/12)*	
	A/ Contents and teaching methods: *(3)* **Contents:** 4.2 Histogram equalization. 4.3 Histogram matching. **Teaching methods**: + Theoretical lectures. + Questions.	G2.1 G2.2
	B/ Self- study contents: *(6)* + Histogram equalization. + Exercises.	G2.1 G2.2 G4.2
8	**<PROGRAMMING INSTRUCTION>** *(3/0/6)*	

	A/ Contents and teaching methods: (3)
	Contents:
	    1. MATLAB for image enhancement.
	Teaching methods:
	    + Intrustion.
		G3.1
		G3.2
		G2.1
		G2.2

	B/ Self- study contents: (6)
	  + Summarize the knowledges.
	  + Exercises.
		G3.1
		G2.1
		G2.2

9	*Chapter 5: <IMAGE FILTERING> (6/0/12)*	

	A/ Contents and teaching methods: (3)
	Contents:
	    5.1 Convolution oporator.
	    5.2 Image filtering in spatial domain.
	Teaching methods:
	    + Theoretical lectures.
	    + Questions.
		G2.2
		G4.2

	B/ Self- study contents: (6)
	  + Prepare for thematic.
	  + Exercises.
		G2.2

10	*Chapter 5: <IMAGE FILTERING (cont.)> (6/0/12)*	

	A/ Contents and teaching methods: (3)
	Contents:
	    5.3 Image filtering in the frequency domain.
	    5.4 Low-pass filter.
	    5.5 High-pass filter.
	Teaching methods:
	    + Theoretical lectures.
	    + Questions.
	    + Thematic guidance.
		G2.2
		G4.2

	B/ Self- study contents: (6)
	  + Summarize the knowledges.
	  + Prepare for thematic.
		G2.2
		G3.1
		G4.2

11	*<EXERCIES AND EXAM> (3/0/6)*	

	A/ Contents and teaching methods: (3)
	Contents:
	    1. Exercises.
	    2. Exam.
	Teaching methods:
	    + Questions and Answers.
	    + Excercises intrustion.
		G1.1-G1.3
		G2.1-G2.2
		G3.2

	B/ **Self- study contents**: *(6)* + Summarize the knowledges.	G1.1-G1.3 G2.1-G2.2 G3.2
12	**< PROGRAMMING EXERCISE REPORT >** *(3/0/6)*	

	A/ **Contents and teaching methods**: *(3)*
	Contents:
	   1 Image enhancement programming.
	   2 Histogram equalization programming.
	   3 Image filetring programming.
	Teaching methods:
	  + Theoretical lectures.
	  + Questions.
		G2.1-G2.3
		G3.1-G3.2
		G4.1-G4.2

	B/ **Self- study contents**: *(6)* + Group discussion. + Review.	G2.1-G2.3 G3.1-G3.2 G4.1-G4.2
13	*Chapter 6:* **< SEGMENTAION AND EDGE DETECTION >** *(6/0/12)*	

	A/ **Contents and teaching methods**: *(3)*
	Contents:
	  6.1 Segmentation detection.
	  6.2 Thresold based segmentation.
	  6.3 Otsu based segmentation.
	Teaching methods:
	  + Theoretical lectures.
	  + Questions.
		G2.4
		G4.2

	B/ **Self- study contents**: *(6)* + Laplace filter based Edge detection. + Exercises. + Prepare for the thematic.	G2.4 G3.1 G4.2
14	*Chapter 6:* **< SEGMENTAION AND EDGE DETECTION (cont.) >** *(6/0/12)*	

	A/ **Contents and teaching methods**: *(3)*
	Contents:
	  6.4 Edge detection method.
	  6.5 Candy filter based edge detection.
	  6.6 Sobel filter based edge detection.
	Teaching methods:
	  + Theoretical lectures.
	  + Questions.
	  + Thematic guidance.
		G2.4
		G3.1

	B/ **Self- study contents**: *(6)*
	    + Summarize the knowledge.
	    + Exercises.
		G2.4
		G3.1
		G4.2

15	**<PROGRAMMING EXERCISES REPORT>**	

	A/ **Contents and teaching methods***: (3)*
	Contents:
	    1 Program the operations for edge dectection.
	    2 Program the operations for segmentation.
	Teaching methods:
	    + Report – Assessment.
		G2.4-G3.2
		G4.1-G4.2

	B/ **Self- study contents**: *(6)*
	    + Summarize the knowledge.
	    + Group discussion.
		G2.4-G3.2
		G4.1-G4.2

12. Learning ethics:

Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get zero point.

13. First approved date:

14. Approval level:

Dean	**Department**	**Instructor**
Assoc. Prof. PhD. **Nguyen Minh Tam**	**Assoc. Prof. PhD.** **Truong Dinh Nhon**	**Assoc. Prof. PhD.** **Nguyen Thanh Hai**

15. Syllabus updated process

1st time: Updated content dated	Instructors
2st time: Updated content dated	Head of department