Form 2B

City University of Hong Kong

Information on a Course offered by Department of Electronic Engineering with effect from Semester A 2012/13

Part I

Course Title: Topics in Image Processing

Course Code: EE5806

Course Duration: One Semester (13 weeks)

No. of credits: 3

Level: P5

Medium of Instruction: English

Prerequisites: Nil

Precursors *:* [MA2149 Mathematical Analysis, or
MA2170 Linear Algebra and Multi-variable Calculus]; and
[EE3210 Signals and Systems, or
EE3118 Linear Systems and Signal Analysis] or
EE5410 Digital Signal Processing

Equivalent Course : Nil

Exclusive Courses: Nil

Part II

Course Aims:

This course aims to provide students with an understanding of digital image processing techniques, including image reconstruction and restoration, pattern recognition and video analysis.

Course Intended Learning Outcomes (CILOs)
Upon successful completion of this course, students should be able to:

No.	CILOs
1.	Describe Image transformations
2.	Describe Image reconstruction and restoration
3.	Describe Image segmentation and pattern recognition
4.	Perform Video analysis
5.	Apply computer algorithms to practical problems

Teaching and Learning Activities (TLAs)

(Indicative of likely activities and tasks designed to facilitate students' achievement of the CILOs. Final details will be provided to students in their first week of attendance in this course)

Indicative of the possible activities and tasks designed to facilitate students' achievement of the CILOs. Fine details will be provided for students upon the commencement of the course.

CILO 1, 2, 3	Lectures, tutorials, on-line learning
CILO 4, 5	Computer projects, demo and presentation

Timetabling Information

Pattern	**Hours**
Lecture:	*26*
Tutorials:	*13*
Laboratory:	
Other activities:	

Assessment Tasks/Activities

(Indicative of likely activities and tasks designed to assess how well the students achieve the CILOs. Final details will be provided to students in their first week of attendance in this course)

	Type of assessment tasks	*Weighting (if applicable)*
Continuous Assessment	Written assignments, Quizzes, Computer projects and Presentation	40%
Examination	Written examination	60% 2 hours

Remarks: To pass the course, students are required to achieve at least 35% in course work and 35% in the examination.

Grading of Student Achievement:

Letter Grade	**Grade Point**	**Grade Definitions**
A+ A A-	4.3 4.0 3.7	Excellent
B+ B B-	3.3 3.0 2.7	Good
C+ C C-	2.3 2.0 1.7	Adequate
D	1.0	Marginal
F	0.0	Failure

Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1, 2	By taking this course, students will learn advanced digital image processing techniques, including various image transformations, image reconstruction from incomplete information, image segmentation and recognition and video sequence analysis.
3	Students will be able to design and conduct digital imaging experiments and analyze and interpret image and video data, as evidenced from computer projects, demo and presentation. Examples include designing a system for image reconstruction from Fourier magnitude only or phase only data and detection of moving objects in video sequences. Students will be encouraged to engage in discovery and innovation related activities, such as studying the latest digital imaging technologies in computer and mobile applications.
4	Students will be able to identify, formulate and solve engineering problems using digital imaging techniques. An example is how to remove the blurring in an image from a moving object. One has to understand how to model the motion, its effect on image formation and remove the motion artifacts under various real world constraints.
5	Students will be able to develop new digital imaging technology and industrial products. For example, student can be asked to do a project on human face image identification on a mobile phone. This requires research and development of efficient hardware and software and the knowledge gained in this course can help student achieve the goals.

Part III

Keyword Syllabus:

Basic Image Processing Methods

Image sampling and quantization; filtering in spatial and frequency domains; color imaging; contrast enhancement.

Image Transformations

The two-dimensional Fourier transform (2D DFT); principal component analysis; 2D autoregressive (AR) and moving average (MA) models; non-linear transforms.

Image Reconstruction and Restoration

Spatial and frequency domain representation of 2D signals; image reconstruction from projections, image reconstruction from Fourier magnitude information only or phase information only; medical imaging systems; projection onto convex sets for image reconstruction and restoration.

Image Segmentation and Pattern Recognition

Pattern recognition techniques; image segmentation; point detection, line detection, edge detection; thresholding, clustering, region growing methods; decision function; pattern classification by distance and maximum likelihood; training techniques; application of AI techniques.

Video Analysis

Kalman filtering, linear prediction, motion detection and estimation; point and line matching, object tracking; efficient computer algorithms.

Applications

Examples include artefact removal from highly compressed images, medical image reconstruction from incomplete information, object detection, tracking and recognition.

Recommended Reading:

M. Sonka, V. Hlavac and R. Boyle, Image Processing, Analysis, and Machine Vision, Third Edition (CL-Engineering, 2007).

Online Resources (if any)