The Hong Kong University of Science and Technology

UG Course Syllabus (Fall 2025-26)

[Course Title] Image Processing

[Course Code] COMP 4421

[No. of Credits] 3

[Any pre-/co-requisites]

Pre-requisite: (COMP 2011 OR COMP 2012 OR COMP 2012H) AND (MATH 2011 OR MATH 2111 OR MATH 2121 OR MATH 2131 OR MATH 2350 OR MATH 2351 OR MATH 2352)

Exclusion: ELEC 4130, MATH 4336

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Course Description

Introduction to image processing. To equip students with the fundamental knowledge of image processing. Topics include image processing and analysis in spatial and frequency domains, image restoration and compression, image segmentation, color image processing, morphological image processing, representation and description, object recognition, related application areas and some other closely related topics. A list of topics includes:

Introduction,

Image Fundamentals,

Image Transformations and Filtering,

Image Restoration and Reconstruction,

Color Image Processing,

Image Compression,

Morphological Image Processing,

Image Segmentation,

Image Registration,

Feature Extraction and Recognition Tasks,

Applications or related topics, e.g., deep learning for medical image analysis.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

-1 Identify basic image enhancement techniques in both the spatial and frequency domains.
-2 Enhance an image in the presence of noise and distortion.
-3 Apply basic morphological image processing techniques.
-4 Segment image components from an image.
-5 Register images with similarity metrics and transformations.
-6 Compress an image with lossless or lossy compression methods.
-7 Represent and describe an image using different feature descriptors.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

[List specific assessed tasks, exams, quizzes, their weightage, and due dates; perhaps, add a summary table as below, to precede the details for each assessment.]

Assessment Task	Contribution to Overall Course grade (%)	Due date
Mid-Term	30%	TBD *
Assignments	30%	TBD *
Final Examination	40%	TBD *

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

[add to/delete table as appropriate]

Assessed Task	Mapped ILOs	Explanation
[Assessed Task 1]	[ILO1, ILO2]	This task assesses students' ability to explain and apply basic image processing concepts (ILO 1 and ILO 2).
[Assessed Task 2]	[ILO1, ILO2, ILO3, ILO4]	This task will assess students' ability to master the concepts (ILO 1 and ILO 2) and apply digital image techniques including morphological image processing (ILO3) and segmentation (ILO4) to typical applications.
[Assessed Task 3]	[ILO4, ILO5, ILO6, ILO7]	This task will assess students' ability to master the concepts (ILO 4 and ILO 5) and apply digital image techniques including registration (ILO 5), compression (ILO 6), and feature extraction (ILO 7) to typical applications.

Grading Rubrics

[Detailed rubrics for each assignment will be provided. These rubrics clearly outline the criteria used for evaluation. Students can refer to these rubrics to understand how their work will be assessed.]

Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	[Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals.]
B	Good Performance	[Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.]
C	Satisfactory Performance	[Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.]
D	Marginal Pass	[Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.]
F	Fail	[Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.]

Course AI Policy

Students are free to use generative AI on their works, and should acknowledge it when used.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will be discussed in the lecture. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Resubmission Policy

Resubmission is generally not allowed.

Required Texts and Materials

This course suggests a list of reference books listed below. No textbook.

Digital Image Processing, by Gonzalez and Woods, 4th Ed., Pearson, 2018.

Digital Image Processing using MATLAB, by Gonzalez and Woods, Prentice Hall, 2004.

The Image Processing Handbook, by John C. Russ (On-line at UST Library).

Digital Image Processing, by Kenneth R. Castleman, Prentice Hall, 1996.

Two-dimensional Signal and Image Processing, by Jae S. Lim, Prentice Hall, 1990.

Computer Vision: A Modern Approach by Forsyth and Ponce, Prentice Hall, 2003.

Toennies, Klaus D. Guide to medical image analysis. Springer London, 2017. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.

Reference book: Excel and Excel VBA Programming for Beginners – 3rd Edition for Office 2013

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Additional Resources

Online course content to be published in HKUST canvas when the semester begins.