Title (Units): **COMP3026 Digital Media Computing (3,2,2)**

Course Aims: Students will learn basic properties of different types of digital media, namely audio, image and video in multimedia systems. Students will then learn the digital media data compression algorithms as well as their international standards. Data compression is the most important enabling technology that makes modern multimedia systems possible.

Prerequisite: COMP2015 Data Structures and Algorithms, MATH2005 Probability and Statistics for Computer Science, MATH 1005 Calculus

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

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Describe different digital media applications and the importance of media compression
2	Explain and describe the fundamental concept of lossy and lossless compression
3	Explain and describe the principle of audio, image and video compression algorithms and the current standards
	Professional Skill
4	Design and develop a digital media compression algorithm using existing available libraries

Calendar Description: This course introduces basic properties of different types of digital media, namely audio, image and video in multimedia systems. As data compression is the most important enabling technology that makes modern multimedia systems possible, data compression algorithms and the international standards of these digital media will be discussed.

Teaching and Learning Activities (TLAs):

CILOs	Type of TLA
1-3	Students will learn lossy and lossless digital media compression knowledge through lectures and tutorials. In order to help students to have good understanding of the media compression theory, laboratory sessions will be designed so that students could apply what they have learnt in lectures. This is also one of the ways to evaluate students' understanding. Besides, assignment(s) and final examination will be designed to test students' level of understanding.
1-4	Based on the compression algorithms they have learned, students are required to work on a media compression project which will be implemented using available library or toolbox. Students are required to give a preliminary demonstration as well as a final formal presentation on their project. In both cases, instructor(s), teaching assistant and other students would ask questions related to their project. In this way, we could assess their media compression programming skills as well as understanding on compression algorithms.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Continuous Assessment	40%	1-4	Students are required to develop a digital media project in a small group. 30% is allocated for the group project. The remaining 10% is allocated for assignment(s) and/or mid-term test.
2	Examination	60%	1-3	The final examination is designed to evaluate students' understanding in different parts. The questions will include fundamental, analytic and design types in order to distinguish different levels of understanding of digital media computing.

Assessment Rubrics:

Level of Achievement	Elaboration on Course Grading Description
Excellent (A)	The student's performance is outstanding in almost all the intended course learning outcomes.
Good (B)	The student's performance is good in most of the intended course learning outcomes.
Satisfactory (C)	The student's performance is satisfactory. It largely meets the intended course learning outcomes.
Marginal Pass (D)	The student's performance is barely satisfactory. It marginally meets the intended course learning outcomes.
Fail (F)	The student's performance is inadequate. It fails to meet many of the intended course learning outcomes.

Course Content and CILOs Mapping:

Content		CILO No.
I	Multimedia Data Representation	1-4
II	Lossless Compression Algorithms	2
III	Lossy Compression Algorithms	2
IV	Image Compression	3-4
V	Basic Video Compression Techniques	3-4
VI	Video Compression	3-4
VII	Audio Compression	3-4

References:

- Z. Li, M. S. Drew and J. Liu, Fundamentals of Multimedia, Springer, 2014.
- G. Friedland and R. Jain, Multimedia Computing, Cambridge University Press, 2014.
- Y. Q. Shi and H. Sun, Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards, Second Edition, CRC Press, 2008.

Course Content:

Topic

I. Multimedia Data Representation
   A. Graphics and image
   B. Color in image and video
   C. Fundamental concepts in video
   D. Basics of digital audio

II. Lossless Compression Algorithms
   A. Basics of information theory
   B. Run-length coding
   C. Variable-length coding
   D. Hoffman coding
   E. Dictionary-based coding
   F. Arithmetic coding

III. Lossy Compression Algorithms
   A. Distortion measures
   B. Quantization
   C. Transform coding
   D. Wavelet-based coding

IV. Image Compression
   A. JPEG algorithm
   B. JPEG 2000 algorithm

V. Basic Video Compression Techniques
   A. Motion compensation
   B. Motion vectors
   C. Inter-frame coding
   D. Inter-frame coding

VI. Video Compression
   A. H.261 algorithm
   B. MPEG 1 algorithm
   C. MPEG 2 algorithm
   D. Introduction to MPEG 4, MPEG 7

VII. Audio Compression
   A. PCM, DPCM, ADPCM
   B. Psychoacoustics
   C. MPEG audio compression algorithm