1. Course Number and Course Title:

COE 639 Digital video compression

2. Credits Hours:

3–0–3

3. Prerequisites and/or Co-Requisites:

Prerequisite: Approval of the CSE Head of Department
Concurrent: None
Competencies: Undergraduate-level courses in statistics and probabilities, and C/C++ programming

4. Name and Contact Information of Instructor:

Dr. Tamer Shanableh

5. Course Description (Catalog Description):

Covers the theory and applications of digital video compression; introduces lossless and lossy compression algorithms; covers transform coding; introduces international compression standards such as JPEG and MPEG; examines digital video transcoding and error resiliency.

6. Textbook and other Supplemental Material:

Textbook:

- Mohammed Ghanbari, *Standard Codecs: Image Compression to Advanced Video Coding*, 3rd edition, 2011, IET Telecommunications Series, ISBN-13: 978-0863419645

Supplementary material:

- Vivienne Sze, Madhukar Budagavi, Gary Sullivan, *High Efficiency Video Coding (HEVC) Algorithms and Architectures*, Springer, 2014, ISBN: 978-3-319-06895-4
- David Salomon, *Handbook of data compression,* 2010, Springer, ISBN-13: 978-1848829022

7. Course learning Outcomes:

Upon completion of the course, students will be able to:

1. Implement basic digital signal processing techniques such as quantization, convolution and Discrete Fourier Transformation
2. Apply concepts of information theory and statistical coding to code data in a lossless manner.
3. Apply image transform using Discrete Cosine Transformation (DCT) and Haar transformation.
4. Explore and analyze various components of single layer video compression including preprocessing, mode selection, block-based prediction, lossy and lossless coding.
5. Expand single layer video codecs into scalable video codecs
6. Design video transcoders for bit rate adaptability, format portability and error resiliency.
7. Develop a no-reference objective video quality assessment system.

8. Teaching and Learning Methodologies:

Methods include lectures; problem and project-based learning methods (simulations, and research paper) and class discussions.

9. Course Topics and Schedule:

Topic	Weeks
Course introduction and Matlab review	Week 1
Information theory and lossless compression	Week 2
Information theory and lossless compression	Week 3
Review of Digital signal processing; sampling, convolution, quantization and DFT	Week 4
Transform coding (DCT and Haar)	Week 5
Transform coding (DCT and Haar)	Week 6
Motion estimation and motion compensation.	Week 7
Motion estimation and motion compensation.	Week 8
Video encoders and decoders + Midterm exam	Week 9
Advanced digital video coding using HEVC	Week 10
Scalable video coding	Week 11
Video transcoding	Week 12
Video compressed domain processing and error resiliency	Week 13
No-reference quality assessment of digital video	Week 14
Review and evaluation, class presentations	Week 15
Final exam	Week 16