1. **Course Number and Course Title:** COE 639 -
    Digital video compression

2. **Credits Hours:**
    3 – 0 – 3

3. **Prerequisites and/or Co-Requisites:** Admission
    to MSCoE program.

4. **Name and Contact Information of Instructor:**
    Dr. Tamer Shanableh
    Office: EB2-206
    Email: tshanableh@aus.edu
    Phone: (06)515-2506
    Office Hours: as posted on *iLearn*; also by appointment.

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:
    *   Ghanbari, M., <u>Standard Codecs: Image Compression to Advanced Video Coding,</u> 3rd edition, 2011, IET Telecommunications Series
    *   Salomon, D., <u>Handbook of data compression,</u> 2010, Springer.
    Other supplemental material:
    *   Research papers relevant to digital video compression.

7. **Learning Outcomes:**
    Upon completion of the course, students will be able to:
    1. Outline basic digital signal processing techniques such as sampling, quantization, convolution and Discrete Fourier Transformation
    2. Apply concepts of information theory and statistical coding to code data in a lossless manner.
    3. Transform images using Discrete Cosine Transformation (DCT) and Haar transformation.
    4. Explore and analyze various components of single layer video compression
    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	1
Review of Digital signal processing; sampling, convolution, quantization and DFT	1.5
Information theory and lossless compression	1.5
Transform coding (DCT and Haar)	2
Motion estimation and motion compensation.	1
Video compression	2
Advanced digital video coding using HEVC	1
Scalable video coding	1
Video transcoding	1
Video compressed domain processing and error resiliency	1
No-reference quality assessment of digital video	1
Review and evaluations.	2
Total:	**16**

10. Schedule of Laboratory and other Non-Lecture Sessions: Not Applicable

11. Out-of-Class Assignments with Due Dates:

Assignment	Due Date (tentative)
HW includes: 1. Information theory 2. binary arithmetic coding 3. Frequency domain processing 4. vector quantization 5. Lossy image compression	One week after announcement
Submission of a review paper on video coding topics	End of Week 10
Video coding Project	End of Week 14

12. Student Evaluation:

Assessment	Weight	Due Date (tentative)
Midterm exam	25%	Week 10
HW and attendance	15%	One week after announcement
Review paper	10%	Week 10
Course project	20%	Week 14
Final Exam	30%	As scheduled by Registrar

13. Contribution of Course to Student Outcomes

This course contributes to the accomplishment of the following program outcomes:

Students Outcome	Extent of Contribution
1. Perform research emphasizing creativity, independent learning and scientific methods in a chosen area of computer engineering	◑
2. Apply advanced mathematics and engineering knowledge in identifying, formulating and solving engineering problems	◑
3. Select and use techniques, skills and modern tools necessary for research or professional practice	◑
4. Communicate effectively	
5. Recognize the need for and engage in life-long learning	
6. Attend to professional and ethical responsibilities	

Extent of contribution: ● high; ◑ medium; ○ low