1. **Course Number and Course Title:**
   COE 494-13 - Computer Vision

2. **Credits Hours:**
   3 – 0 – 3

3. **Prerequisites and/or Co-Requisites:**
   Prerequisite: CMP 220 Programming II and MTH 221 Linear Algebra

4. **Name and Contact Information of Instructor:**
   Name: Dr. Omar Arif
   Email: oarif@aus.edu
   Office: ESB-2178
   Phone: (06) 515-4821
   Office Hours: Posted on office door and iLearn; also by appointment

5. **Course Description (Catalog Description):**
   Provides a comprehensive introduction to computer vision, imparting students with a deep understanding of fundamental concepts and practical skills for real-world applications. Includes image formation, filtering, feature extraction and matching and advanced concepts such as 3D reconstruction, optical flow, image classification, detection, segmentation, and tracking. Explores convolutional and recurrent neural networks and their applications in computer vision.

6. **Textbook and other Supplemental Material:**
   Textbook:
   - Szeliski, Richard, *Computer Vision: Algorithms and Applications*, 2nd ed., Springer, 2022.

7. **Course Learning Outcomes:**
   Upon completion of the course, students will be able to:
   1. Describe the foundation of image formation and image processing.
   2. Analyze different edge detection and feature extraction algorithms.
   3. Apply different key point detection and matching algorithms in real-world applications.
   4. Employ convolutional neural networks in computer vision applications.
   5. Apply knowledge of multi-view geometry and structure from motion in 3D reconstruction.
   6. Design computer vision systems using state-of-the-art algorithms and software tools.

8. **Teaching and Learning Methodologies:**
   Methods include lectures, problem and project-based learning methods (assignments, exams, project, presentation), and class discussions.

9. **Course Topics and Schedule:**

Topic	Week
Introduction to Computer Vision	Week #1
Image Formation and Filtering	Week #2
Edge Detection	Week #3
Corner Detection	Week #4
Image Features Detection	Week #5
Image Feature Matching	Week #6
Artificial Neural Networks	Week #7
Convolutional Neural Network	Week #8
Image Classification, Midterm Exam	Week #9
Object Detection	Week #10
Object Segmentation	Week #11
Multiview Geometry	Week #12

Structure from Motion	Week #13
Optical Flow	Week #14
Object Tracking	Week #15
Final Exam	Week #16

10. Schedule of Laboratory and other Non-Lecture Sessions:

This course has no labs.

The project is designed to assess students' understanding of the course material and their ability to apply computer vision techniques to real-world problems. Working in groups of three is expected.

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

Assignment	Due Date (tentative)
Homework 1: Image filtering and representation	Week #4
Homework 2: Feature Extraction and Matching	Week #7
Homework 3: Object Recognition	Week #11
Homework 4: Multiview Geometry	Week #14
Project	Week #14

12. Student Evaluation:

Assessment	Weight	Due Date (tentative)
Homework (x4)	10%	Cf. Section 11
Quizzes (x2)	10%	Weeks #5, #11
Project	20%	Cf. Section 11
Midterm Exam (x2)	25%	Week #8, #13
Final Exam	35%	Week #16

13. Assessment Instruments:

Assessment	Course Learning Outcomes
Homework	O1 – O6
Quizzes	O1 – O6
Project	O3 – O6
Midterm Exam	O1 – O3
Final Exam	O1 – O6

14. Contribution of Course to Program Outcome:

BSCS Program Outcomes	Emphasis in this course	Course Learning Outcomes
(1) Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.	○	O1
(2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	●	O2–O6
(3) Communicate effectively in a variety of professional contexts.		
(4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.		
(5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.		

(6) Apply computer science theory and software development fundamentals to produce computing-based solutions.	◑	O2–O6

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected

BSCoE Program Outcomes	**Emphasis in this course**	**Course Learning Outcomes**
(1) Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	◑	O1–O6
(2) Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	○	O4, O6
(3) Communicate effectively with a range of audiences		
(4) Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts		
(5) Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives		
(6) Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	◑	O4–O6
(7) Acquire and apply new knowledge as needed, using appropriate learning strategies		

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected

15. Letter Grade Policy:

Total (T)	**Letter Grade**
$95 \leq T$	A
$90 \leq T < 95$	A-
$85 \leq T < 90$	B+
$80 \leq T < 85$	B
$75 \leq T < 80$	B-
$70 \leq T < 75$	C+
$65 \leq T < 70$	C
$60 \leq T < 65$	C-
$55 \leq T < 60$	D
$T < 55$	F

16. Use of Generative AI tools:

The use of Generative AI (GAI) tools, such as ChatGPT and others, is prohibited during Quizzes, Midterm, and the Final exam. However, you are permitted to utilize these tools for Homework and Project, provided due acknowledgment is given.

It is considered an academic integrity violation to represent output of a **generative artificial intelligence** tool as your own work.

17. **Course Policies:**
    - **Integrity:** All students are to abide by the university's integrity code. Any form of academic dishonesty, including complicity, will result in the immediate expulsion from the classroom and referral of the case to the dean's office. More information is available in the academic integrity section of the university catalog.
    - **Attendance:** Lecture attendance is mandatory and will be enforced per university's attendance and lateness policies described in the catalog. Students missing 15% of the semester hours will be dropped from the course.
    - **Electronic devices:** All electronic and communication devices e.g., smart watches and mobile phones are prohibited during quizzes, exams. You will get zero if you are found with electronic devices.
    - **Assignment:** Once an assignment is posted, no extension will be given. Late submissions will not be accepted.
    - **Makeups:** No makeups will be made for midterm exams and the quizzes. If you have a valid excuse (sick leave which is verified by university clinic) the weightage will be adjusted in the final exam.
    - **Grades** for assessments will be made available on iLearn after each assessment. If you have any concerns or disputes about your grades, please submit them within one week of the posting date. No change will be entertained after that.