COSC 5590 SELECTED TOPICS:
Mathematical Methods in
Computer Graphics, Imaging and Vision*

Fall 2011

I. General Information
Time/location: TR 9:30-10:45am, BH-112
Professor: Dr. Hongyu Guo
Office: CI-305
Office hours: MW 2:00pm-4:30pm or by appointment
Phone: (361) 825-3492
Email: hongyu.guo@tamucc.edu

Textbook (required):
• Lecture Notes: Modern Mathematics for Computer Graphics, Imaging and Vision, by Hongyu Guo

Prerequisite: None

II. Course Description
This course introduces fundamental theories and mathematical methods and helps the students to build the mathematical skills needed in the study and research in computer graphics, imaging and vision. Topics include: linear algebra, color and color spaces, tensor algebra, projective geometry and camera geometry.

III. Student Learning Outcomes
Upon successful completion of this course, a student will be able to
• understand vectors, matrices and linear transformations
• understand color theory and practical color models like RGB and CMYK
• understand the concept of contravariant tensors and covariant tensors
• understand and apply projective geometry and camera geometry

IV. Outline of Course Topics (tentative)

• Linear Algebra
  o linear spaces
  o linear mappings
  o dual spaces
  o contravariant vectors and covariant vectors
  o inner product spaces
• Color and Color Spaces
  o physics of color
  o electromagnetic spectrum
  o human trichromatic color vision
  o linear color spaces
  o RGB and CMYK color models
  o white point and color temperature

• Quaternion Algebra

• Tensor Algebra
  o bilinear mappings
  o tensor product
  o tensor spaces
  o tensor algebra

• Projective Geometry
  o perspective drawing
  o one-point, two-point and three-point perspective
  o models of the projective plane
  o homogeneous coordinates
  o projective transformations
  o fundamental theorem of projective geometry

• Camera Geometry (time permits)
  o pinhole cameras
  o perspective projection
  o cameras with thin lenses
  o optics of cameras
  o human eyes
  o depth of field
  o camera parameters and perspective projection

V. Course Evaluation
There will be graded non-programming exercises. There will be a midterm exam. The students are also going to write a research paper.
The course grade will be determined as follows:
exercises 25%
midterm exam 35%
paper 25%
presentation 10%
class attendance and participation 5%

VI. Late Submissions
Late submissions are not accepted.
VII. Backup Copies and Grading Errors
The students are required to make backup copies of both their electronic and hardcopy submissions and keep ALL graded materials. The department makes the best effort to maintain the systems but it may not be held liable for loss of data stored on the systems in the event of system failures. In case of any grading or recording errors or doubts, the student may be asked to show the backup submission or the graded material for correction or verification. All grading disputes must be resolved within one week after the graded material is returned to the student.

VIII. Exams and Makeup Exams
The students are required to come to the exams on time. A student coming to the exam 30 minutes or more after the exam starting time is not allowed to take the exam and will receive a zero grade on the exam. This policy is the same to all students, including students requesting for special accommodations.
No student is allowed to leave the classroom within the first 30 minutes of the exam.
There will be no makeup exams. Arrangements can be made in case of emergency but the student needs to inform the professor in advance unless the emergency is unexpected and the student needs a letter from the office of academic affairs.

IX. Class Attendance
Class attendance and active participation is required and makes up 5% of the total grade. The student is STRONGLY ENCOURAGED to ask questions during the lectures and this is viewed as part of the class participation. Five or more unexcused absences will result in the loss of that 5% of the total grade. If the student is absent from class, he or she is responsible for any materials covered, handouts and any announcements made in class, regarding (but not limited to) class schedule, homework, project and exams. Cell phones must be turned off during class.

X. Collaboration Policy
All assignments and projects must be completed individually, if they are not assigned to teams. On individual assignments, the students MAY NOT work together. The students may ask each other for general advice, but they may not share final answers. Word to word copy from another student or from the work of previous semesters (especially word to word copy of wrong answers) is evidence of cheating and "We did the homework together" is not an excuse.

XI. Academic Dishonesty
The student is expected to avoid all forms of academic dishonesty as defined in the Catalog. In addition, students are expected to behave in an ethical manner in all class and lab activities. If the student feels uncertain about a particular activity, he/she should speak to the professor BEFORE problems arise. If cheating is found, the student receives 0 score for that particular homework assignment, project or exam. In addition, the final grade will be down graded one letter grade. That is A to B, B to C, C to D, D to F and F to F.
XII. Notice to Students with Disabilities
Texas A&M University-Corpus Christi complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. If you suspect that you may have a disability (physical impairment, learning disability, psychiatric disability, etc.), please contact the Services for Students with Disabilities Office, located in Driftwood 101, at 825-5816. If you need disability accommodations in this class, please see me as soon as possible.

XIII. Academic Advising
The College of Science and Technology requires that students meet with an Academic Advisor. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. The College's Academic Advising Center is located in Faculty Center 178, and can be reached at 825-6094.

XIV. Grade Appeal Process
As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade.

XV. Bibliography/References
2. David Forsyth and Jean Ponce, Computer Vision – A Modern Approach, Prentice Hall
3. Marvin Marcus, Finite Dimensional Multilinear Algebra, Marcel Dekker, Inc.

*Note: This syllabus is subject to change. Any changes will be announced in class. It is the student's responsibility to obtain this information.