Syllabus:
PHS 542: Integrated Math and Physics

Summer at ASU

(2018: Bob Rowley, Robert.J.Rowley@asu.edu)

Catalog description: Mathematical models and modeling as an integrating theme for secondary mathematics and physics. Enrollment by teams of mathematics and physics teachers encouraged.

COURSE DESCRIPTION:

A. Overview:

Week 1: Teaching theory with Dr. Hestenes, introduction to the four math models, introductory activities with Geogebra and GlowScript.

Week 2: Math Model 1 (MM1: constant rate of change), similarity & ratio problems, linear graphs, slopes. Introduction to Geometric Algebra (GA) in 2D. Introduction to MM2 (constant change in rate), parabolas and their graphs.

Week 3: Continue MM2, parabolas in projectile motion, GA Primer treatment. MM3 (rate proportional to amount), exponentials and their graphs, Professor Bartlett's treatment of exponential growth and non-renewable resource lifetime.

Week 4: MM4 (change in rate proportional to amount), trig functions, Euler's formula as used in GA, oscillatory motion in physics applications. GA Primer topics in classical physics, 3D rotations.

Week 5: Continue GA Primer topics. Beginning relativity using GA treatment. Some standard relativity examples from the GA viewpoint.

B. Course plan and rationale: Daily handouts. Some theory, many cooperative practice activities, homework assignments, and either a final exam or final project. One goal is to deepen teacher understanding of the importance of the mathematical models which span a large portion of physics topics. The other goal is to familiarize teachers with the benefits of Geometric Algebra, so that they may be encouraged to introduce GA basics to high school students, since it can aid in understanding of geometry and vector operations.

STUDENT LEARNING OUTCOMES:

At successful course completion, students will have

- deepened their understanding of four basic mathematical models in physics,
- become acquainted with Geometric Algebra for math and physics,
- practiced teamwork and communication to improve their instruction,
- improved their instructional pedagogy by incorporating inquiry methods, critical and creative thinking, and cooperative learning, in the context of mathematical modeling.

LISTING OF ASSIGNMENTS:

This course meets for 47.5 hours (19 days), and ABOR requires that you do at least 90 hours of work outside of class. Assignments will be listed by the instructor, daily.

GRADING POLICIES:

A-B-C grades: B means average; a 3.0 GPA is minimum requirement for MNS and other graduate degrees. Grades are based on attendance, participation, homework, and final exam.

Policies of Arizona Board of Regents (ABOR), ASU, and Department of Physics:

* ABOR: Each student is expected to work a minimum of 45 hours per semester hour of credit.
* Pass-fail is not an option for graduate courses. https://students.asu.edu/grades-grading-policies.
* 3.0 grade point average (GPA) is minimum requirement for MNS & other graduate degrees.
* Incomplete: only for special circumstances. Must finish course within 1 year, or it becomes "E".
* An instructor may drop a student for non-attendance during the first two class days (in summer).
* An instructor may withdraw a student with a mark of "W" or a grade of "E" only in cases of "disruptive classroom behavior".
* The ASU Department of Physics is critical of giving all A's, because it indicates a lack of discrimination. A grade of "B" (3.0) is an average graduate course grade, and obviously not all students do above-average work compared to their peers. Some of you can expect to earn a "B", and those who are below average but do acceptable work will earn a "C".

Academic dishonesty policy: Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions, and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see http://provost.asu.edu/academicintegrity.

Disability policy: Qualified students with disabilities who require disability accommodations in this course are encouraged to make their requests to the instructor on the first class day or before. Note: Prior to receiving disability accommodations, verification of eligibility from the Disability Resource Center (DRC) is required. Disability information is confidential.

REQUIRED INSTRUCTIONAL MATERIALS:

No textbook. Optional is a 3-ring binder (preferably 1 inch thick); 6 tab inserts.
Either access to the GA Primer (http://geocalc.clas.asu.edu/GA_Primer/GA_Primer/) or a personal copy of the GA Primer as PDF. Access to the internet for free math software tools Geogebra and GlowScript.

REQUIRED MEDIA: None.

REQUIRED READING: Daily handouts, selected topics from the GA Primer.

RECOMMENDED READING: None.