**EE 472 – Space Astronomy and Introduction to Space Science**

**Credits and Contact Hours:** 3 credits; two 75-minute lectures per week.

**Course Coordinator:** John D. Mathews

**University Bulletin Description:** EE 472 (AERSP 492) (3) The physical nature of the objects in the solar system; the earth's atmosphere, ionosphere, radiation belts, magnetosphere, and orbital mechanics.
Prerequisite: EE 300 or PHYS 400.

**Prerequisites by Topics:**

1. Understanding and the ability to use basic concepts from electomagnetics;
2. Understanding of the basic mechanics and physical concepts represented in **F**=m**a**;
3. Understanding and the ability to apply basic integral and differential calculus;
4. Proficiency in the use of Matlab for basic calculations;

**Designation:** Elective course for electrical and other engineering majors.

**Course Outcomes:**

This course provides the foundational education in electronic circuit analysis and design. Through lecture, laboratory, and out-of-class assignments, students are provided learning experiences that enable them to:

1. To introduce students to the fundamentals of space science;
2. Space science topics will be sufficient to allow an engineer or scientist to account for the basic properties expected to be encountered while designing an instrument for operation in space and/or to understand the role of various instruments in studying the space environment;
3. Become proficient with computer skills (e.g., Multisim) for the analysis and design of circuits;
4. Develop technical writing skills important for effective communication.

## Course Topics:

1. Introduction to orbital mechanics with low-earth orbit, geosynchronous orbits, and transfer orbits emphasized;
2. Numerical solutions to the gravitational orbital differential equations (Project);
3. Kepler’s Laws and the history of astronomy;
4. Introduction to astronomical coordinate systems;
5. Introduction to the Lorentz force equation and charged particle orbits in constant electric and magnetic fields;
6. Numerical solutions to charged particle orbit differential equations (Project);
7. Review of the Maxwell equations, magnetic and electric fields, and waves;
8. Review of grad, div, and curl;
9. Introduction to plasmas and the propagation of EM waves in plasmas;
10. Derivations of EM wave equations and the cold plasma dispersion relationship;
11. EM wave dispersion in plasmas and pulsars (Project);
12. Introduction to MHD and the magnetosphere;
13. The sun and the ionosphere;
14. Global climate, space weather, current events;
15. Time and frequency keeping and GPS;
16. Launch mechanics of single/multi-stage rockets (Project).

**Student Outcomes Addressed:**

**O.4.1. Graduates will have an in-depth technical knowledge in one or more areas of specialization.**

**O.4.2. Graduates will have a practical understanding of the major electrical engineering concepts and demonstrate application of their theoretical knowledge of the concepts.**

**Prepared by:** John D. Mathews **Date:** May 15, 2014