# Tamkang University Academic Year 111, 1st Semester Course Syllabus

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| Course Title | ELECTROMAGNETICS IN AEROSPACE | Instructor | WANG KAITI |
| Course Class | TENXM1A<br>MASTER'S PROGRAM, DEPARTMENT OF AEROSPACE ENGINEERING, 1A | Details | ◆ General Course<br>◆ Selective<br>◆ One Semester |
| Relevance to SDGs | SDG4 Quality education<br>SDG13 Climate action | | |

## Departmental Aim of Education

Ⅰ. To lay down a concrete foundation of professional ethics in aerospace and aeronautical engineering, and to cultivate the students' ability in multidisciplinary expertise and continuous learning.

Ⅱ. To setup the students' hands-on ability of and the ability in resolving problem, so that both practical implementations and theories can be emphasized.

Ⅲ. To foster students with diligent and sociable attitude in work, and broadeded international perspective.

## Subject Departmental core competences

A. To equip with specific aerospace engineering knowledge and expertise.(ratio:30.00)

B. Be able to master information, capable of utilizing computer to assist solving problems, and possess the ability of conducting learning new knowledge.(ratio:40.00)

C. Be able to design and conduct experiments as well as to analyze, and to solve practical aerospace related engineering problems.(ratio:10.00)

D. Be able to write professional research papers in the field of aerospace engineering. (ratio:10.00)

E. Have a creative thinking, complete analyzing, effective communication, the spirit of teamwork and the ability to solve industrial problems.(ratio:10.00)

## Subject Schoolwide essential virtues

1. A global perspective. (ratio:30.00)
2. Information literacy. (ratio:25.00)
3. A vision for the future. (ratio:10.00)
4. Moral integrity. (ratio:5.00)
5. Independent thinking. (ratio:15.00)
6. A cheerful attitude and healthy lifestyle. (ratio:5.00)

7. A spirit of teamwork and dedication. (ratio:5.00)

8. A sense of aesthetic appreciation. (ratio:5.00)

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| Course Introduction | This course will introduce fundamental electromagnetic equations, space electromagnetic and radiation environment, satellite observations, and space weather. The fundamental equations are Maxwell' s equations including Gauss' s Law, Faraday' s Law, and Ampère' s Law. They will be applied to equations for charged particles motion in a magnetic field environment in space plasma. The space environment will be covered from the Sun, solar wind, to our magnetospheres. How charged particles waves behave in the environment will be discussed accordingly. |

**The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.**

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.

II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.

III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

| No. | Teaching Objectives | objective methods |
|---|---|---|
| 1 | 1. Knowledge of fundamental equations of electromagnetics.<br>2. Knowledge of motion of charged particles in electromagnetic environment.<br>3. Knowledge of solar-terrestrial environment from the Sun to Earth.<br>4. Knowledge of particles and waves observations from satellite missions. | Cognitive |

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment

| No. | Core Competences | Essential Virtues | Teaching Methods | Assessment |
|---|---|---|---|---|
| 1 | ABCDE | 12345678 | Lecture, Discussion, Practicum | Testing, Study Assignments, Discussion(including classroom and online), Activity Participation |

Course Schedule

| Week | Date | Course Contents | Note |
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| 1 | 111/09/05 ~ 111/09/11 | Basic Equations in Electromagnetics I | |
| 2 | 111/09/12 ~ 111/09/18 | Basic Equations in Electromagnetics II | |
| 3 | 111/09/19 ~ 111/09/25 | Introduction to Space Plasma | |
| 4 | 111/09/26 ~ 111/10/02 | Charged Particles Motion in Space Plasma | |
| 5 | 111/10/03 ~ 111/10/09 | Drifts from Electric Field and Gradient of Magnetic Fields | |
| 6 | 111/10/10 ~ 111/10/16 | Drifts from Curvature of Magnetic Fields | |
| 7 | 111/10/17 ~ 111/10/23 | Solar Activity | |
| 8 | 111/10/24 ~ 111/10/30 | Solar Wind Interaction with Celestrial Bodies | |
| 9 | 111/10/31 ~ 111/11/06 | Magnetosphere I / Review | |
| 10 | 111/11/07 ~ 111/11/13 | Midterm Exam Week | |
| 11 | 111/11/14 ~ 111/11/20 | Magnetosphere II | |
| 12 | 111/11/21 ~ 111/11/27 | Energetic Particle Sources | |
| 13 | 111/11/28 ~ 111/12/04 | Radiation Belt I | |
| 14 | 111/12/05 ~ 111/12/11 | Radiation Belt II | |
| 15 | 111/12/12 ~ 111/12/18 | Space Weather I | |
| 16 | 111/12/19 ~ 111/12/25 | Satellite Observations | |
| 17 | 111/12/26 ~ 112/01/01 | Review | |
| 18 | 112/01/02 ~ 112/01/08 | Final Exam Week | |

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| Requirement | |
| Teaching Facility | Computer, Projector |
| Textbooks and Teaching Materials | Griffith, D. J., Introduction to Electrodynamics, 4th Edition, Pearson, 2012.<br>Chen, F., Introduction to Plasma Physics and Controlled Fusion, 3rd Edition, Springer, 2016 |
| References | Kivelson, M. G., and C. T. Russell, Introduction to Space Physics, 1st Edition, Cambridge University Press, 1995<br>Gurnett, D. A., and A. Bhattacharjee, Introduction to plasma physics : with space, laboratory and astrophysical applications, Cambridge University Press, 2017 |
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| Number of Assignment(s) | 6 (Filled in by assignment instructor only) |
| Grading Policy | ◆ Attendance： 5.0 % ◆ Mark of Usual： % ◆ Midterm Exam： 30.0 %<br>◆ Final Exam： 30.0 %<br>◆ Other〈Homework, Quizzes〉：35.0 % |
| Note | This syllabus may be uploaded at the website of Course Syllabus Management System at http://info.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/CS/main.php .<br>**※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.** |