

## Tamkang University Academic Year 109, 1st Semester Course Syllabus

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| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | DIGITAL CONTROL SYSTEM                                                  | Instructor | TYAN FENG                                                                                                       |
| Course Class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | TENXM1A<br>MASTER'S PROGRAM, DEPARTMENT OF<br>AEROSPACE ENGINEERING, 1A | Details    | <ul style="list-style-type: none"> <li>◆ General Course</li> <li>◆ Selective</li> <li>◆ One Semester</li> </ul> |
| D e p a r t m e n t a l   A i m   o f   E d u c a t i o n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                         |            |                                                                                                                 |
| <p>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.</p> <p>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.</p> <p>III. To foster students with diligent and sociable attitude in work, and broadened international perspective.</p>                                                                                                                                                                                                                 |                                                                         |            |                                                                                                                 |
| Subject Departmental core competences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                         |            |                                                                                                                 |
| <p>A. To equip with specific aerospace engineering knowledge and expertise.(ratio:25.00)</p> <p>B. Be able to master information, capable of utilizing computer to assist solving problems, and possess the ability of conducting learning new knowledge.(ratio:25.00)</p> <p>C. Be able to design and conduct experiments as well as to analyze, and to solve practical aerospace related engineering problems.(ratio:25.00)</p> <p>D. Be able to write professional research papers in the field of aerospace engineering.<br/>(ratio:10.00)</p> <p>E. Have a creative thinking, complete analyzing, effective communication, the spirit of teamwork and the ability to solve industrial problems.(ratio:15.00)</p> |                                                                         |            |                                                                                                                 |
| Subject Schoolwide essential virtues                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                         |            |                                                                                                                 |
| <p>1. A global perspective. (ratio:30.00)</p> <p>2. Information literacy. (ratio:30.00)</p> <p>3. A vision for the future. (ratio:20.00)</p> <p>5. Independent thinking. (ratio:20.00)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                         |            |                                                                                                                 |

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| Course Introduction | Digital control system provides the insight, knowledge, and understanding required to analyze and design computer-controlled systems, from theory to practical implementation. This course includes an introduction to sampled-data control systems, discretization of analog systems, discrete-time systems, time-invariance, Z-transforms, stability, state-space models, pole assignment, deadbeat control. In particular, students will learn about modelling and analyzing feedback control systems in which the plant is an analogue, continuous-time system, but where the controller is a digital computer. |
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**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   | Introductory of Digital Control                                           | Cognitive         |
| 2   | familiar with Discrete system analysis, discrete equivalents, Z-transform | Cognitive         |
| 3   | Design using state-space method, multivariable and optimal control        | Cognitive         |
| 4   | System identification, nonlinear control and case study                   | Cognitive         |

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

| No. | Core Competences | Essential Virtues | Teaching Methods    | Assessment         |
|-----|------------------|-------------------|---------------------|--------------------|
| 1   | ABCDE            | 1235              | Lecture, Discussion | Testing, home work |
| 2   | ABCDE            | 1235              | Lecture, Discussion | Testing, home work |
| 3   | ABCDE            | 1235              | Lecture, Discussion | Testing, home work |
| 4   | ABCDE            | 1235              | Lecture, Discussion | Testing, home work |

**Course Schedule**

| Week | Date                     | Course Contents                                | Note |
|------|--------------------------|------------------------------------------------|------|
| 1    | 109/09/14 ~<br>109/09/20 | Introduction, Review of Continuous Time System |      |

|                                  |                          |                                                                                                                 |  |
|----------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------|--|
| 2                                | 109/09/21 ~<br>109/09/27 | Introductory of Digital Control                                                                                 |  |
| 3                                | 109/09/28 ~<br>109/10/04 | Discrete System Analysis                                                                                        |  |
| 4                                | 109/10/05 ~<br>109/10/11 | Sampled-Data Systems                                                                                            |  |
| 5                                | 109/10/12 ~<br>109/10/18 | Discrete Equivalents                                                                                            |  |
| 6                                | 109/10/19 ~<br>109/10/25 | Design Using Transform Techniques                                                                               |  |
| 7                                | 109/10/26 ~<br>109/11/01 | Design Using State-Space Methods                                                                                |  |
| 8                                | 109/11/02 ~<br>109/11/08 | Design Using State-Space Methods                                                                                |  |
| 9                                | 109/11/09 ~<br>109/11/15 | Midterm Exam                                                                                                    |  |
| 10                               | 109/11/16 ~<br>109/11/22 | Multivariable and Optimal Control                                                                               |  |
| 11                               | 109/11/23 ~<br>109/11/29 | Multivariable and Optimal Control                                                                               |  |
| 12                               | 109/11/30 ~<br>109/12/06 | Quantization Effects, Sample Rate Selection                                                                     |  |
| 13                               | 109/12/07 ~<br>109/12/13 | System Identification                                                                                           |  |
| 14                               | 109/12/14 ~<br>109/12/20 | System Identification                                                                                           |  |
| 15                               | 109/12/21 ~<br>109/12/27 | Nonlinear Control                                                                                               |  |
| 16                               | 109/12/28 ~<br>110/01/03 | Nonlinear Control                                                                                               |  |
| 17                               | 110/01/04 ~<br>110/01/10 | case study                                                                                                      |  |
| 18                               | 110/01/11 ~<br>110/01/17 | Final Exam                                                                                                      |  |
| Requirement                      |                          | Work Hard, Make yourself be familiar with MATLAB.                                                               |  |
| Teaching Facility                |                          | Computer, Projector, Other (MATLAB)                                                                             |  |
| Textbooks and Teaching Materials |                          | T.B.D.                                                                                                          |  |
| References                       |                          | G. F. Franklin, J. D. Powell and M. Workman, "Digital Control of Dynamic Systems," 3rd ed, Addison Wesley, 1998 |  |
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| Number of Assignment(s) | <b>6</b> (Filled in by assignment instructor only)                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Grading Policy          | ◆ Attendance :                %    ◆ Mark of Usual : 15.0 %    ◆ Midterm Exam : 35.0 %<br>◆ Final Exam :    50.0 %<br>◆ Other (    ) :                %                                                                                                                                                                                                                                                                                                                                                                      |
| Note                    | This syllabus may be uploaded at the website of Course Syllabus Management System at <a href="http://info.ais.tku.edu.tw/csp">http://info.ais.tku.edu.tw/csp</a> or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at <a href="http://www.acad.tku.edu.tw/CS/main.php">http://www.acad.tku.edu.tw/CS/main.php</a> .<br><b>※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.</b> |