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| Tsuyama College                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Year | 2020                                                                                    |                        | Course Title                                                                             | Digital Signal Processing                                                           |
| Course Information                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Course Code                                                                                                                                                                                             | 0154                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | Course Category                                                                         | Specialized / Elective |                                                                                          |                                                                                     |
| Class Format                                                                                                                                                                                            | Lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | Credits                                                                                 | Academic Credit: 2     |                                                                                          |                                                                                     |
| Department                                                                                                                                                                                              | Department of Integrated Science and Technology Communication and Informations System Program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | Student Grade                                                                           | 5th                    |                                                                                          |                                                                                     |
| Term                                                                                                                                                                                                    | Second Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | Classes per Week                                                                        | 2                      |                                                                                          |                                                                                     |
| Textbook and/or Teaching Materials                                                                                                                                                                      | Textbooks:Masafumi Hagiwara,"Digital Signal processing"(Morikita Publishing Co.,LTD)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Instructor                                                                                                                                                                                              | YABUKI Noboru                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Course Objectives                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Learning purposes :<br>Learn the basic theory of digital signal processing.In addition, learn basic techniques related to digital image processing, which are often used for digital signal processing. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Course Objectives :<br>1. To understand the theory of digital signal processing.<br>2. To understand the basic technology related to digital image processing.                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Rubric                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
|                                                                                                                                                                                                         | Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | Good                                                                                    |                        | Acceptable                                                                               | Not acceptable                                                                      |
| Achievement 1                                                                                                                                                                                           | The student can use the theory of digital signal processing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | The student can fully explain the basic theory of digital signal processing.            |                        | The student understands the basic theory of digital signal processing. (test)            | The student can't explain the basic theory of digital signal processing.            |
| Achievement 2                                                                                                                                                                                           | The student can apply technology related to digital image processing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      | The student can fully explain the basic technology related to digital image processing. |                        | The student Understands the basic technology related to digital image processing (test). | The student can't explain the basic technology related to digital image processing. |
| Assigned Department Objectives                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Teaching Method                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Outline                                                                                                                                                                                                 | General or Specialized : Specialized<br>Field of learning : Information system programming network<br>Required, Elective, etc. : Elective must complete subjects(Network program chooser),Others are elective subject, but this year's course will start do not do.<br>Foundational academic disciplines : Electrical and electronic engineering and related fields / Communication and network engineering-related<br>Relationship with Educational Objectives :<br>This class is equivalent to "(3) Acquire deep foundation knowledge of the major subject area"<br><br>Relationship with JABEE programs :<br>The main goal of learning / education in this class are "(A)... A-2..."<br><br>Course outline :<br>Comparing analog processing and digital processing has advantages and disadvantages. In recent years, the number of devices and application examples that digitally process analog signals has increased because they are suitable for compression, recording, transmission, and so on. As the basis for these applications, you will learn the basic theory of digital signal processing and the basic technology of images. |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Style                                                                                                                                                                                                   | Course method :<br>Classes will be conducted using textbooks and supplementary materials, centered on board writing. In addition, related theorems will be supplementarily explained as necessary. Also, impose exercises and quiz reports to deepen understanding. (This class is offered semi-annually)<br><br>Grade evaluation method :<br>Examination(60%)+Exercises and report assignments (40%).<br>Regular examinations will be conducted 2 times, with each equally weighted.(60%)<br>・ Each test does not allow notebooks to be brought in.<br>・ For those who have less than 60 points in each regular test, supplementary lessons will be given, and if the understanding can be confirmed by the retest, the points may be changed. However, the evaluation after the change shall not exceed 60 points.<br>This subject is a compulsory subject to study outside of class hours. Evaluate learning outcomes (exercises, report assignments) outside of class hours (40%).                                                                                                                                                           |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Notice                                                                                                                                                                                                  | Precautions on the enrollment :<br>For network program choosers, this is a "class that requires study outside of class hours" . Classes are offered for 15 hours per credit, but 30 credit hours are required in addition to this. Follow the instructions of your instructor for these studies.<br>Course advice :<br>The basic technology of audio and images will be explained. Furthermore, in order to acquire specific processing, it is necessary to create a program by yourself.<br>Foundational subjects : Fundamenntals of Integrated Science and Technology(1st year), Digital Circuits(2nd), Digital Engineering (3th), Information System Development(3th), Communication Engineeringcal Engineering(4th)<br>Related subjects : Information Theory(5th year), Image Processing(EC-2nd), etc.<br><br>Attendance advice :<br>In order to understand digital signal processing, it is better to create a program by yourself and check its operation. It is also good to create an image processing program.<br>Check for late arrivals in quarters of class time.Late arrivals of 25 minutes or more are treated as one absence.     |      |                                                                                         |                        |                                                                                          |                                                                                     |
| Course Plan                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |                                                                                         |                        |                                                                                          |                                                                                     |
|                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | Theme                                                                                   |                        | Goals                                                                                    |                                                                                     |

|              |             |      |                                                     |                                                                                                                                                                    |
|--------------|-------------|------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2nd Semester | 3rd Quarter | 1st  | Guidance, What is signal processing?                | To understand overview of the relationship between signal processing and mathematics                                                                               |
|              |             | 2nd  | Fourier series (trigonometric function)             | Understand the principles and applications of Fourier series expansion using trigonometric functions.                                                              |
|              |             | 3rd  | Fourier series (trigonometric function)             | Understand the relationship between trigonometric and complex functions for Fourier series expansion.                                                              |
|              |             | 4th  | Fourier transform                                   | Understanding the Fourier Transform by extending the periodic waveform to the aperiodic waveform.                                                                  |
|              |             | 5th  | Characteristics and properties of Fourier transform | Learn the basic knowledge for performing analysis with Fourier transform.                                                                                          |
|              |             | 6th  | Laplace transform                                   | Learn about the relationship between the Fourier transform and the Laplace transform.                                                                              |
|              |             | 7th  | Features and properties of Laplace transform        | Learn the basic knowledge to perform analysis with Laplace transform.                                                                                              |
|              |             | 8th  | 2nd semester mid-term exam                          | Check what you have learned so far.                                                                                                                                |
|              | 4th Quarter | 9th  | Return and commentary of exam answers               | Check and supplement the areas where learning is insufficient. Learn the relationship between the z-transform and the Laplace transform".                          |
|              |             | 10th | Features and properties of z-transform              | Learn the basic knowledge to perform analysis with z-transform.                                                                                                    |
|              |             | 11th | Discrete Fourier transform, features and properties | Learn the basic knowledge for performing analysis with DFT.                                                                                                        |
|              |             | 12th | Discrete time system                                | Learn the basic knowledge for performing analysis with DFT.                                                                                                        |
|              |             | 13th | Digital image processing (1)                        | Learn the expression of image processing as an application of digital signal processing (pixels, gradations, grayscale images, color images, binary images, etc.). |
|              |             | 14th | Digital image processing (2)                        | Learn various processing methods for image processing (spatial filtering, frequency filtering, etc.).                                                              |
|              |             | 15th | (2nd semester final exam)                           | Check what you are learning.                                                                                                                                       |
|              |             | 16th | Return and commentary of exam answers               | "Check where learning is inadequate and supplement".                                                                                                               |

#### Evaluation Method and Weight (%)

|                         | Examination | Assignments / Mini test | Total |
|-------------------------|-------------|-------------------------|-------|
| Subtotal                | 60          | 40                      | 100   |
| Basic Proficiency       | 0           | 0                       | 0     |
| Specialized Proficiency | 60          | 40                      | 100   |
| Cross Area Proficiency  | 0           | 0                       | 0     |