Electronic Circuits

Syllabus Number 3E208
Basic Major Subjects
Elective Requisites 2 credit

KOBAYASHI, Yasuyuki

1. Course Description

You can find many applications in various areas if you understand the fundamental and important subjects of the analog electronic circuit system which consists of an electronic device. Therefore, you will learn the fundamental concepts of amplifier circuits and equivalent circuits essential for understanding the analog electronic circuit system, and will be taught about the analog electronic circuits for various applications. You should often review subjects taught in class in the homework reports in order to improve understanding of the analog electronic circuits.
This subject puts emphasis on lectures, therefore, another subject "Exercises in Electronic Circuits" has practical training with exercise of various electronic circuits.
This subject corresponds to the diploma policy DP4E.

2. Course Objectives

According to DP4E, our aim is the study of fundamental and important subjects concerning analog electronic circuit systems which are essential to electronic engineers. In details, students will understand the fundamental and important subjects of the analog electronic circuit system which consists of an electronic device, and will be able to explain and calculate the electronic circuits.

3. Grading Policy

Those who attend 10 or more lectures of the total 15 lectures will be given the qualifications of the regular examinations. The overall grade of this course will be decided based on the sum of total 100 points of the midterm exam (40 points), the final exam (40 points), and the score of the exercises (20 points), and those whose grade is 60 or more will pass.
The score of the exercises will be proportional to the number of the passed exercises submitted before each due date, and the maximum score of the exercises is 20 points.
For feedback, the answer of the exercise will be explained right after submitting it, and the exercise will be corrected and returned in the later session. Each final due date of the exercise is the date of the class a week later. No delay of submitting the exercises are allowed.

4. Textbook and Reference

Textbook
supervised by M. Iemura Nyu-mon dens-ikairo for analog circuits, ISBN: 4-274-20317-4 Ohm-sha
The slides shown in the class and the exercises will be open to LMS.
Reference
S. Wada et al. Foundations for specialty: electronic circuits, ISBN:978-4-407-34779-1 Jikkyo Publishing

5. Requirements(Assignments)

For preparations of each class, students must read and organize the contents, and must do the example questions in the relevant part of the textbook (about 1.0 hour).
For reviews of each class, students must do the exercises in LMS (about 2.0 hour).

6. Note

This subject will keep pace with another subject called "Exercises in Electronic Circuits." To understand thoroughly the electronic circuit theory studied in this subject, you should also take "Exercises in Electronic Circuits" in addition to this subject.
The students who attend this subject are supposed to finish the electrical circuits, and are at least supposed to be able to calculate direct current circuits.
This subject may show many writings on the blackboard during lecture, therefore, please understand it and do your best at this subject.
If you are planning to take "Experiments in Fundamental Electronics 1 or 2," or "Experiments of Electronics 1 or 2," you should attend this subject.
LMS will be used in this subject.

7. Schedule

[1] Introduction and semiconductor devices (1) p-n junction and diodes: Basic concepts of semiconductor devices and diodes as a basic device will be explained. The relevant parts of the textbook are Chapters 1 and 2.

[2] Semiconductor devices (2) other devices and what is bipolar transistor? (1): An outline of transistors and the structure, types, and input-output characteristics of the bipolar transistors as the main objects of this subject will be explained. You should understand the bipolar transistor controls and amplifies currents. The relevant parts of the textbook are Secs. 3.1 to 3.3.

[3] Variables for amplifying circuits and what is bipolar transistor? (2): The concepts of amplification degree, gain, and decibel (dB) will be explained. And the output circuits after transistor's amplifying and an analysis method with plotting will be explained. The relevant parts of the textbook are Secs. 3.3 to 3.5, and 4.4 to 4.5.

[4] Bias of transistor's amplifying circuit (1): Necessary conditions for bias circuits that is important for transistor amplifier circuits and the fixed bias circuit, which is basic, will be explained. The relevant parts of the textbook are Secs. 4.3, 4.5, 5.1, 5.2, and 5.5.

[5] Bias of transistor's amplifying circuit (2): A fluctuation of the fixed bias circuit and the self-bias circuit and the current feedback bias circuit that reduce the fluctuation will be explained. The relevant parts of the textbook are Secs. 5.3 to 5.4.

[6] Small signal equivalent circuit for transistor amplifier circuits (1): The Method to separate the DC component and the AC component in transistor amplifier circuits, and examples applied for the fixed bias circuit and the current feedback bias circuit will be explained. The relevant parts of the textbook are Secs. 4.5 and 5.5.

[7] Small signal equivalent circuit for transistor amplifier circuits (2): The model using h-parameters for a bipolar transistor to approximate for a small signal equivalent circuit will be explained. The relevant parts of the textbook are Secs. 3.4, 4.6, and 6.1 to 6.3.

[8] Small signal equivalent circuit for transistor amplifier circuits (3) and high frequency amplifier: The method to apply a small signal equivalent circuit to the fixed bias circuit and the current feedback bias circuit, and the concepts of input and output impedance will be explained. The relevant parts of the textbook are Secs. 6.3 to 6.5.

[9] Conclusions of the former half and midterm exam: The degree of understanding from the 1st class to the 8th class will be examined.

[10] Operational amplifier (1): The concept of operational amplifiers and their functions will be explained. And an inverting amplifier, one of the fundamental circuits with operational amplifiers will be explained. The relevant parts of the textbook are Secs. 6.5, and 12.1 to 12.2.

[11] Operational amplifier (2): a non-inverting amplifier, a voltage-follower, an analog-adder, an integrator, a differentiator, etc. which are the fundamental circuits with operational amplifiers will be explained. The relevant part of the textbook is Sec. 12.2.

[12] Feedback amplifiers and oscillation circuits (1): As feedback amplifiers, the principles of negative feedback amplifiers and oscillation circuits will be explained. And RC oscillation circuits as an example of oscillation circuits will be explained. The relevant parts of the textbook are Secs. 10.1 and 10.2.

[13] Oscillation circuits (2): LC oscillation circuits and crystal-oscillator circuit as examples of oscillation circuits will be explained. And the principle of phase locked loop oscillator circuit will be explained. The relevant parts of the textbook are Secs. 10.3 to 10.5.

[14] Measurement theory of high-frequency: The concepts of distributed constant circuits, characteristic impedance, and impedance-matching technique will be explained. The relevant part of the textbook is a material for distributed constant circuits on LMS.

[15] Measurement devises for high-frequency, electronic measurement devices, and signal oscillator: Supposing understanding the concepts of distributed constant circuits, measurement characteristics for impedance-matching technique and a network analyzer will be explained. And measurement devices particular to high-frequency, a signal oscillator, etc. will be explained. The relevant part of the textbook is a material for measurement devises for high-frequency on LMS.