

## (電機工程學系/通訊工程學系) (110 學年度)

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| 課程名稱：（中文）電子學（一）<br>（英文）Electronics I                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      | 開課單位 | 電機工程學系 / 通訊工程學系         |    |    |      |                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      | 課程代碼 | 4152006_02 / 4302002_02 |    |    |      |                      |
| 授課教師：吳建華                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 學分數                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                              | 3                                                                                                                                                                                                                                                                                 | 必／選修 | 必修   | 開課年級                    | 大二 |    |      |                      |
| 先修科目或先備能力：                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 課程概述：To introduce the electronic solid state devices such as diodes and Metal Oxide Semiconductor Field Effect Transistors (MOSFETs). The physical principles of these nonlinear devices will be covered with an understanding the current-voltage (I-V) characteristics. The equivalent circuit models will be used to describe the operation of amplifier. This course provides the requisite background for Electronics II |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 課程目標：                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| (1) Analyze the amplifiers.<br>(2) Describe the diode operation.<br>(3) Explain the operation of MOSFETs.<br>(4) Design single stage amplifiers and Inverter.<br>(5) Understanding the operation of differential amplifier                                                                                                                                                                                                    |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 教科書                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Textbook：</b><br>A. S. Sedra and K.C. Smith, “Microelectronic Circuits”, 8th edition, Oxford, 2021, ISBN：978019-0853350-1.<br><b>Reference Books：</b><br>Behzad Razavi, “Fundamentals of Microelectronics,” John Wiley & Sons, 2008, ISBN：978-0471478466. |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 課程大綱                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      | 分配時數                    |    |    | 核心能力 | 備註                   |
| 單元主題                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                              | 內容綱要                                                                                                                                                                                                                                                                              |      |      | 講授                      | 示範 | 習作 |      |                      |
| Ch.1<br>Electronics and Semiconductors                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                              | (1) Intrinsic Semiconductors<br>(2) Doped Semiconductors<br>(3) Current Flow in Semiconductors<br>(4) The pn Junction with Open-Circuit Terminals (Equilibrium)<br>(5) The pn Junction with Applied Voltage<br>(6) Capacitive Effects in the pn Junction                          |      |      | 6                       |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| Ch.3<br>Diodes                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                              | (1) The Ideal DiodeTerminal<br>(2) Terminal Characteristics of Junction Diodes<br>(3) Modeling the Diode<br>(4) Small-Signal Model<br>(5) Voltage Regulation<br>(6) Rectifier Circuits<br>(7) Other Diode Applications                                                            |      |      | 6                       |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| Ch.5<br>MOS Field-Effect Transistor                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                              | (1) Device Structure and Physical Operation<br>(2) Current—Voltage Characteristics<br>(3) MOSFET Circuits at DC<br>(4) Technology Scaling (Moore’s Law) and other                                                                                                                 |      |      | 9                       |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| Ch.6<br>Transistor Amplifiers                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                              | (1) Basic Principles<br>(2) Small-signal operation and models<br>(3) Basic Configuration：CS, CG, Source follower<br>(4) Basing<br>(5) Discrete-circuit amplifier                                                                                                                  |      |      | 10                      |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| Ch.7<br>Building Blocks of Integrated-Circuit Amplifiers                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                              | (1) IC Design Philosophy<br>(2) IC Biasing：Current sources and current mirrors<br>(3) The Basic Gain Cell<br>(4) The common-gate amplifier as current buffers<br>(5) The Cascode Amplifier<br>(6) The IC source follower<br>(7) Current-Mirror Circuits with Improved Performance |      |      | 10                      |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| Ch8<br>Differential Amplifier                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                              | (1) MOS Differential Pair<br>(2) Common-mode rejection<br>(3) DC offset<br>(4) The different amplifier with a current mirror load                                                                                                                                                 |      |      | 10                      |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| Ch.14<br>CMOS Digital Logic Circuits                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                              | (1) Digital Logic-gate circuits<br>(2) Digital Logic Inverters<br>(3) The CMOS Inverter                                                                                                                                                                                           |      |      | 3                       |    |    |      | ●1.1<br>●2.1<br>●4.4 |
| 教學要點概述 <sup>2</sup> ：                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 教材編選：■自編教材      □教科書作者提供                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |
| 教學方法：■投影片講述    ■板書講述    □實例示範    □操作練習                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                   |      |      |                         |    |    |      |                      |

評量方法：■ 平常考（0%）■ 期中考（66%）■ 期末考（34%）■ 其它（0%）

教學資源：□課程網站    ■教材電子檔供下載    □其他 \_\_\_\_\_

教學相關配合事項：

核心能力

●1.1 ○1.2 ○1.3 ●2.1 ○ 2.2 ○3.1 ○3.2    ○4.1 ○4.2 ○4.3 ●4.4

1.1 瞭解電機/通訊工程基礎知識。

提供電機/通訊工程各領域後續相關課程的理論基礎。

1.2 培養電機/通訊工程實作能力。

1.3 訓練技術報告寫作與簡報的能力。

2.1 培養分析問題的能力。

本課程注重於電子電路問題之分析，

2.2 培養善用資源以解決問題的能力。

3.1 培養溝通與表達的能力

3.2 訓練運用個人專長，與他人合作完成專案計畫

4.1 瞭解國內外相關產業現況。

4.2 理解工程倫理及社會責任。

4.3 培養良好的資訊能力。

4.4 培養科技英文能力。

本課程內容以英文教材進行。

註：1. 其他欄包含參訪、專題演講等活動。

2. 教學要點請填寫教材編選、教學方法、評量方法、教學資源、教學相關配合事項等。