


**國立東華大學**  
**教學計劃表 Syllabus**

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| 課程名稱(中文)<br>Course Name in Chinese                                                                                                                                                                                                                                                                                                                          | 類比積體電路設計                                                                                                                                                                                                 |                             |    | 學年/學期<br>Academic Year/Semester    | 113/2                                                                                    |
| 課程名稱(英文)<br>Course Name in English                                                                                                                                                                                                                                                                                                                          | Analog Integrated Circuit Design                                                                                                                                                                         |                             |    |                                    |                                                                                          |
| 科目代碼<br>Course Code                                                                                                                                                                                                                                                                                                                                         | EE_M0190                                                                                                                                                                                                 | 系級<br>Department & Year     | 碩士 | 開課單位<br>Course-Offering Department | 電機工程學系                                                                                   |
| 修別<br>Type                                                                                                                                                                                                                                                                                                                                                  | 選修 Elective                                                                                                                                                                                              | 學分數/時間<br>Credit(s)/Hour(s) |    | 3.0/3.0                            |                                                                                          |
| 授課教師<br>Instructor                                                                                                                                                                                                                                                                                                                                          | /翁若敏                                                                                                                                                                                                     |                             |    |                                    |                                                                                          |
| 先修課程<br>Prerequisite                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                          |                             |    |                                    |                                                                                          |
| 課程描述 Course Description                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                          |                             |    |                                    |                                                                                          |
| CMOS技術主要應用於數位電路，由於製程的日新月異，現今也用於設計高性能類比電路。本課程為大學部電子學進階之類比電子電路介紹與分析。結合相關課程，學習電路設計、模擬與驗證的技巧。<br>本課程介紹類比積體電路的基本原理與電路設計等內容，重點是以CMOS電晶體電為主，建立類比積體電路設計基礎。主要的課程內容包括有：類比訊號重要性、主被動元件介紹、單級放大器、運算放大器、回授放大器、電流鏡、頻率響應、壓控振盪器、鎖相迴路等，可培養類比積體電路設計與分析的基本能力                                                                                                                     |                                                                                                                                                                                                          |                             |    |                                    |                                                                                          |
| 課程目標 Course Objectives                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                          |                             |    |                                    |                                                                                          |
| 學習CMOS類比積體電路設計的基本理論與頻率響應分析，熟悉積體電路的設計與製程，並經由電路模擬軟體驗證類比電路之特性。<br>To learn the basic theories of CMOS analog integrated circuit design and the analysis of frequency response.<br>To become familiar with integrated circuit design and manufacturing processes, as well as verify the characteristics of analog circuits through circuit simulation software. |                                                                                                                                                                                                          |                             |    |                                    |                                                                                          |
| 系專業能力<br>Basic Learning Outcomes                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                          |                             |    |                                    | 課程目標與系專業能力相關性<br>Correlation between Course Objectives and Dept.' s Education Objectives |
| A                                                                                                                                                                                                                                                                                                                                                           | 培育具備電機電子資訊工程等專業技術研發之能力。To cultivate the research and developing ability of electrical, electronics and information engineering。                                                                          |                             |    |                                    | ●                                                                                        |
| B                                                                                                                                                                                                                                                                                                                                                           | 培育系統分析、模擬驗證、實作實現之能力。To cultivate the advanced ability of analysis, verification and implementation of systems。                                                                                           |                             |    |                                    | ●                                                                                        |
| C                                                                                                                                                                                                                                                                                                                                                           | 訓練軟體工具使用與硬體實務驗證相互輔助之能力To train the auxiliary ability between the utilization of software tool and the verification of the hardware practice。                                                             |                             |    |                                    | ●                                                                                        |
| D                                                                                                                                                                                                                                                                                                                                                           | 訓練電機電子資訊專業知識與工程實務相互結合運用之能力。To train the integrate ability between professional EECS knowledge and engineering practice                                                                                   |                             |    |                                    | ●                                                                                        |
| E                                                                                                                                                                                                                                                                                                                                                           | 落實論文研究之群體討論與團隊合作之互助能力。To fulfill the research ability in thesis by group discussion and teamwork cooperation                                                                                             |                             |    |                                    | ○                                                                                        |
| F                                                                                                                                                                                                                                                                                                                                                           | 落實發掘問題、邏輯分析、克服瓶頸與持續學習之能力。To fulfill the ability of question finding, logical analyzing, bottleneck overcoming and continuous learning                                                                    |                             |    |                                    | ●                                                                                        |
| G                                                                                                                                                                                                                                                                                                                                                           | 了解學術倫理與智慧財產觀念，掌握國內外產業更迭需求與具備多元專長之能力。To obtain the ability of multi-specialization and to meet the industry demand as well as to have the ability of academic ethics and concept of intellectual property |                             |    |                                    | ○                                                                                        |
| H                                                                                                                                                                                                                                                                                                                                                           | 了解國內外市場變化，具備科技英文閱讀溝通與科技論文寫作之能力。To understand the change of global market and to have the ability of reading, conversation and technical writing in English。                                              |                             |    |                                    | ○                                                                                        |
| 圖示說明Illustration：● 高度相關 Highly correlated ○ 中度相關 Moderately correlated                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                          |                             |    |                                    |                                                                                          |

| 授 課 進 度 表 Teaching Schedule & Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------|
| 週次Week                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 內 容 Subject/Topics                       | 備 註Remarks |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1. Introduction to Analog Design         |            |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2. Basic MOS Device Physics              |            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3. Single-Stage Amplifier                |            |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3. Single-Stage Amplifiers               |            |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4. Differential Amplifiers               |            |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4. Differential Amplifiers               |            |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5. Passive and Active Current Mirrors    |            |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6. Frequency Response of Amplifiers      |            |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 期中考試週 Midterm Exam                       |            |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 7. Noise                                 |            |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 8. Feedback                              |            |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 8. Feedback                              |            |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9. Operational Amplifiers                |            |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9. Operational Amplifiers                |            |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10. Stability and Frequency Compensation |            |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 17. CMOS processing Technology           |            |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 18. Layout and Packaging                 |            |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 期末考試週 Final Exam                         |            |
| 教 學 策 略 Teaching Strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                          |            |
| <input checked="" type="checkbox"/> 課堂講授 Lecture <input type="checkbox"/> 分組討論Group Discussion <input type="checkbox"/> 參觀實習 Field Trip<br><input type="checkbox"/> 其他Miscellaneous:                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                          |            |
| 教 學 創 新 自 評 Teaching Self-Evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                          |            |
| 創新教學(Innovative Teaching)<br><input type="checkbox"/> 問題導向學習(PBL) <input type="checkbox"/> 團體合作學習(TBL) <input type="checkbox"/> 解決導向學習(SBL)<br><input type="checkbox"/> 翻轉教室 Flipped Classroom <input type="checkbox"/> 磨課師 Moocs<br>社會責任(Social Responsibility)<br><input type="checkbox"/> 在地實踐Community Practice <input type="checkbox"/> 產學合作 Industry-Academia Cooperation<br>跨域合作(Transdisciplinary Projects)<br><input type="checkbox"/> 跨界教學Transdisciplinary Teaching <input type="checkbox"/> 跨院系教學Inter-collegiate Teaching<br><input type="checkbox"/> 業師合授 Courses Co-taught with Industry Practitioners<br><br>其它 other: |                                          |            |

| 學期成績計算及多元評量方式 Grading & Assessments                                                                                                                                                                                                                                                                |                    |                    |          |          |          |          |          |          |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|----------|----------|----------|----------|----------|----------|----|
| 配分項目<br>Items                                                                                                                                                                                                                                                                                      | 配分比例<br>Percentage | 多元評量方式 Assessments |          |          |          |          |          |          |    |
|                                                                                                                                                                                                                                                                                                    |                    | 測驗<br>會考           | 實作<br>觀察 | 口頭<br>發表 | 專題<br>研究 | 創作<br>展演 | 卷宗<br>評量 | 證照<br>檢定 | 其他 |
| 平時成績(含出缺席)<br>General Performance<br>(Attendance Record)                                                                                                                                                                                                                                           | 20%                |                    |          |          |          |          |          |          |    |
| 期中考成績 Midterm Exam                                                                                                                                                                                                                                                                                 | 0%                 |                    |          |          |          |          |          |          |    |
| 期末考成績 Final Exam                                                                                                                                                                                                                                                                                   | 60%                |                    |          |          |          |          |          |          |    |
| 作業成績 Homework and/or<br>Assignments                                                                                                                                                                                                                                                                | 20%                |                    |          |          |          |          |          |          |    |
| 其他 Miscellaneous<br>(_____)                                                                                                                                                                                                                                                                        |                    |                    |          |          |          |          |          |          |    |
| 評量方式補充說明<br>Grading & Assessments Supplemental instructions                                                                                                                                                                                                                                        |                    |                    |          |          |          |          |          |          |    |
| 教科書與參考書目(書名、作者、書局、代理商、說明)<br>Textbook & Other References (Title, Author, Publisher, Agents, Remarks, etc.)                                                                                                                                                                                         |                    |                    |          |          |          |          |          |          |    |
| (1)Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, McGraw-Hill, Inc., 2002. (滄海)<br>(2)類比CMOS積體電路設計 劉深淵教授 審閱 / 李峻實 譯(滄海).                                                                                                                                                              |                    |                    |          |          |          |          |          |          |    |
| 課程教材網址(含線上教學資訊,教師個人網址請列位於本校內之網址)<br>Teaching Aids & Teacher's Website(Including online teaching information.<br>Personal website can be listed here.)<br><a href="http://www.elearn.ndhu.edu.tw/moodle/course/view.php?id=46288">http://www.elearn.ndhu.edu.tw/moodle/course/view.php?id=46288</a> |                    |                    |          |          |          |          |          |          |    |
| 其他補充說明 (Supplemental instructions)                                                                                                                                                                                                                                                                 |                    |                    |          |          |          |          |          |          |    |