

國立中正大學機械工程學系 115 學年度第 1 學期教學大綱表

課程名稱(中文) 光機電專題實作(一) (英文) Opto-Mechatronic Design Practice (I)					開課單位	機械系
					課程代碼	4223702 4213506
授課教師	姚賀騰	學分數	3	必修	開課年級	大三
全英文授課 EMI	☐ 是 ☒ 否					
課程類別 course type	☐ 人文關懷課程 ☐ 競賽專題課程 ☒ 問題導向課程 ☒ 專題導向課程 ☒ 總整課程 ☒ 實作課程 ☐ 實習 ☐ 其他					
先修科目或先備能力：自動控制(一)、電子電路(一)。						
<u>課程概述：</u> This mechatronic course comprises a series hands-on control classes on design of servomotors that will be applied to automation and robots in the course Mechatronic Design Practice (2). Via this course, any attendant will be capable of developing position, velocity, and torque -servo motors, given a DC motor attached with an encoder and a current sensor, respectively. A servo controller is wired by transducers, MCU controller, power converter, and communicator. Here position transducer is the encoder, the velocity transducer is encoder plus a phase-lock loop (PLL) circuit, and the torque is real-time measured by Hall current transducer. The MCU controller is programmed with white-noise and color noises filters as well as PI feedback. Switching buck chopper is introduced as the motor driver, of which the gate-driving circuit is driven by the PWM signals output from the dsPIC controller. Those servocontrollers are then connected to iOS APP through Arduino and Bluetooth to accept commands from the owner or 4G neighbors.						
<u>目標：</u> Learn the following: 1. Concept of Microcontrollers 2. Implementation of transfer function into a MCU controller 3. Implementation of Proportion-Integration-Differentiation feedback 4. Introduction of sensor and encoder 5. Implementation of Bulk and Boost circuit of DC voltage circuits 6. Implementation to Circuit of Operational Amplifier 7. Concept of low pass and high pass filter 8. Image detection and identification						
教科書	1. Class slides 2. Manual of experiments 3. Self-made teaching materials 4. “AVR Microcontroller and Embedded System: Using Assembly and C” by M. A. Mazidi, S. Naimi, and S. Naimi 5. “Make: AVR Programming – Learning to Write Software for Hardware” by E. Williams 「請尊重智慧財產權，不得非法影印教師指定之教科書籍」					
教學要點概述						

教材編選 teaching materials	☒ 自製簡報(ppt) ☐ 課程講義 ☐ 自編教科書 ☐ 教學程式 ☐ 自製教學影片 ☐ 其他			
教學方法 teaching methods	☒ 講述 ☐ 小組討論 ☐ 學生口頭報告 ☐ 問題導向學習 ☐ 個案研究 ☐ 其他			
評量工具 Evaluation tools	☐ 期中考 ☒ 期末考 ☐ 隨堂測驗 ☐ 隨堂作業 ☒ 課後作業 ☐ 期中報告 ☐ 期末報告 ☐ 專題報告 ☐ 評量尺規 ☐ 其他			
教學資源 teaching resources	☐ 課程網站 ☒ 教材電子檔供下載 ☐ 實習網站			
教師相關訊息 instructor's information	機械館 528 室分機 33323			

課程大綱		分配時數				可達成核心能力
單元主題	內容綱要	講授	示範	習作	其他 ₁	
Synthesis of filters	Principles and Applications of Microcontrollers/Arduino digital I/O	2	6			B1,B3,B4,B6,B7
dsPIC programming basics	1. Serial communication and Advanced Arduino programming 2. DC motor control and Arduino PWM	2	6			B1,B3,B4,B6,B7
dsPIC programming advances	Concept of low pass and high pass filter	2	6			B1,B3,B4,B6,B7
Encoder and bulk boost control	1. Rotary encoder and Stepper motor 2. Bulk and Boost circuit of DC voltage	2	4			B1,B3,B4,B6,B7
Motor driver	1. PID controlling of DC motor 2. DC motor modeling	2	4			B1,B3,B4,B6,B7
Image dealing	Image detection and identification	2	6			B1,B3,B4,B6,B7
Controller layout	1. Circuit of Operational Amplifier 2. AVR microcontrollers	2	6			B1,B3,B4,B6,B7
可達成核心能力		核心能力達成指標				
B1	具備基本工程數學、固體力學、熱流力學、自動控制及材料科學分析的能力	具備基本自動控制的能力				
B3	執行固力實驗、熱流實驗、自控制實驗、電子學實驗和分析數據的能力	執行自控制實驗的能力				
B4	撰寫程式語言與電腦輔助設計的能力	撰寫程式語言的能力				
B6	發掘、分析及解決專業問題的能力	發掘、分析及解決專業問題的能力				
B7	實作與創新的能力	實作與創新的能力				

B9	具備團隊合作、有效溝通及計畫管理的能力	具備團隊合作及有效溝通的能力		
教學要點概述：理論闡述加實作範例				
上課時間	上課地點	學習成果評量方式	Office hour	教學品質評量方式
A 班：二 10-12 B 班：四 10-12	創新 201	兩次考試，期中考佔二十分，期末考佔二十分。實作成果佔六十分。點名加分二十，但總分一百分。	星期四 14:00-16:00	教學意見調查 核心能力重要性 及達成度分析問卷
週次	教 學 與 作 業 進 度			備 註
1	Introduction to Capstone projects			
2	Principles and Applications of Microcontrollers/Arduino digital I/O			
3	Serial communication and Advanced Arduino programming			
4	DC motor control and Arduino PWM			
5	Arduino analog input and Infrared sensor			
6	Rotary encoder and Stepper motor			
7	Transformers and rectifiers			
8	Bulk and Boost circuit of DC voltage			
9	Capstone midterm inspection			Midterm exam
10	DC motor modeling			
11	PID controlling of DC motor			
12	Circuit of Operational Amplifier			
13	Concept of low pass and high pass filter			
14	Image detection and identification			
15	AVR microcontrollers			
16	Experiment make-up			
17	Final experiment exam practice			
18	Capstone final inspection			Final exam
其他：				