【附件三】教育部教學實踐研究計畫成果報告格式(系統端上傳 PDF 檔)

教育部教學實踐研究計畫成果報告(封面)

Project Report for MOE Teaching Practice Research Program (Cover Page)

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(配合課程名稱/Course Name) 嵌入式作業系統

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執行機構及系所(Institution/Department/Program)：交通大學電機系

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引導系統工程學生從「會發問」到產生學習熱忱的行動研究

一. 報告內文(Content)(至少 3 頁)

1. 研究動機與目的(Research Motive and Purpose)

本計畫擇定的實踐研究課程在電機學院電控所的專業課程地圖中有其特殊性，「嵌入式作業系統」定位在於嵌入式系統（硬體）與應用程式（軟體）之間，通常應用在比較複雜、需要多工支援的嵌入式系統上。故而，嵌入式作業系統對電機背景的學生，比起電子/電路設計、自動控制、基礎程式等課程來說，屬於學生較少接觸的陌生領域，修課學生較不容易想像作業系統存在的角色與必要性。

本計畫的申請動機，在於主持人履履與修課生互動時發現，同學雖然能在小考中正確回覆問題(Remembering)，但如果課程進行到實驗操作時，主持人認為學生應該具備使用熟記的作業系統原件原理去設計或解決問題，分析該元件與問題之間的關係，以及該元件的應用方式（understanding、analyzing、applying），但卻往往發生在真實環境經學生無法明白課程知識的用處，因為缺乏知識的應用力，導致學生期末專題所設計/實現的系統可操作性非常低。

因此，主持人認為，如果學生學習只是依賴教師的單向傳授，即使是熟悉的專業知識，卻不能應用，或者連學生自己也不知道自己沒有學會，這也會影響高等教育資源的投入效果，實在可惜。為此，透過本計畫的系統化教學設計，想要引導系統工程學生從課堂上就「會發問」，開始思考所學，中間透過主持人/助教的引導對話，習慣會發問，到進入期末專題實際操作產生學習熱忱的高峰經驗，提高學生的學習效率，是本計畫的行動研究的動機。

2. 文獻探討(Literature Review)

在工程領域方面，台灣教育逐漸重視實作課程，透過做中學培養學生的實務經驗。引導學生主動參與「構思(conceive, C)- 設計(design, D)- 實現(implementation, I)- 運作(operation, O)」的教育理念與模式 (Crawley 2002, Zha 2008, Tan 2009) 也逐漸被引入工程教育中，透過產品研發到上市運行的生命週期，逐步養成學生主動思考、積極實踐的學習習慣與態度。對工程背景的學生來說，CDIO 的訓練精神著重於培養學生的工程基礎知識、實作能力、團隊合作能力和工程系統能力等四個層面，期能透過多面向的訓練，讓工程學生能養成全人精神，並且能學以致用。

Rubrics 是更詳細的將教師所期待的學生學習成果描述陳列出來，讓教師在教學過程中可以依循，同時，透過評量，教師可以取得資訊，了解學生在哪一項的核心能力上學習得較好、哪一項較弱，以及未來要再教授該門課程時，該如何改善。而學生也可以知道課程內涵為何、教師的要求為何、會評量的方向為何。一旦學生有了這些認知，在取得成績後，也較能了解自己學習較佳之處為何、較弱之處為何、未來學習應加強的方向為何（劉曼君，2014）。

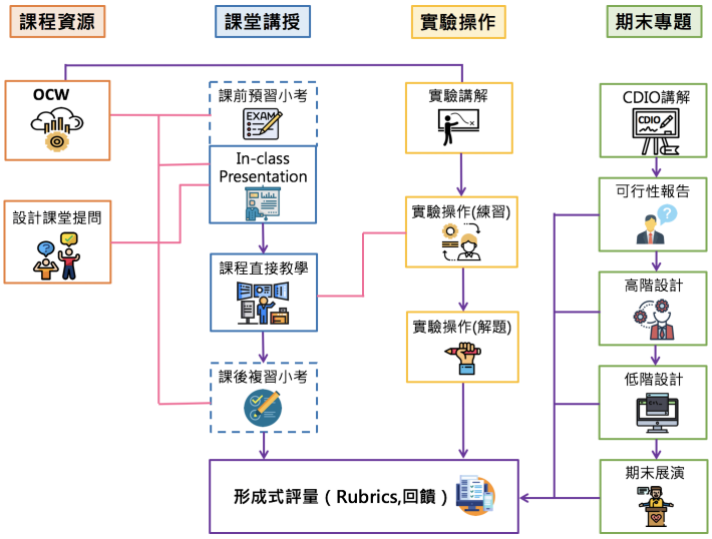
3. 研究問題(Research Question)

本計畫研究希冀透過系統化教學設計，引導系統工程學生從課堂上就「會發問」，開始思考所學。主持人堅信學生學會問出問題的同時，也是學生開始能掌握該教學主題的時候。工程背景的學生理解力都有一定的基礎，但對於陌生、初接觸的主題，仍須一些時間吸收、消化後，方能妥當的應用出來。主持人常遇到校友回饋，他們往往在進入產業、實際接觸產品與系統之後，才頓悟當年所學（雖然他們都能回答課堂中的考題），只可惜錯失與老師深入互動的機會。此確係單向教育（講授法）的不足。

為了讓學生在修課期間，能熟悉所講解的主題，本計畫希望於課堂間透過主持人（教師）/助教的引導對話，打破單向教育的藩籬；也期望逐步加深對話內容，讓學生對於每個主題產生深入探討的動機。這樣的對話模式，對學生應用所學至實際系統設計的能力、學生的學習成效，能產生何種催化，此係本計畫待研究之問題。

4. 研究設計與方法(Research Methodology)

本計畫課程以交通大學電機控制研究所的「嵌入式作業系統」為主。該課程主要可分為四個部分（課程資源、課堂講解、實驗操作及期末專題），課程規畫如下圖所示。首先是課前透過 OCW 課程備課，主持人已經錄製 OCW 影片，提供學生課前預習或課後複習之用。課程進行時採發問（In-class Presentation）策略，讓學生用自己的語言「說出」他們學到概念，主持人並於課前先設計課堂提問問題，以確實掌握學生對課堂學習的理解程度。除了分組報告與發問外，主持人亦將不定期舉行課前預習小考與課後複習小考，提供學生一定程度的學習壓力。



圖五　引導系統工程學生從「會發問」到產生學習熱忱的教學流程

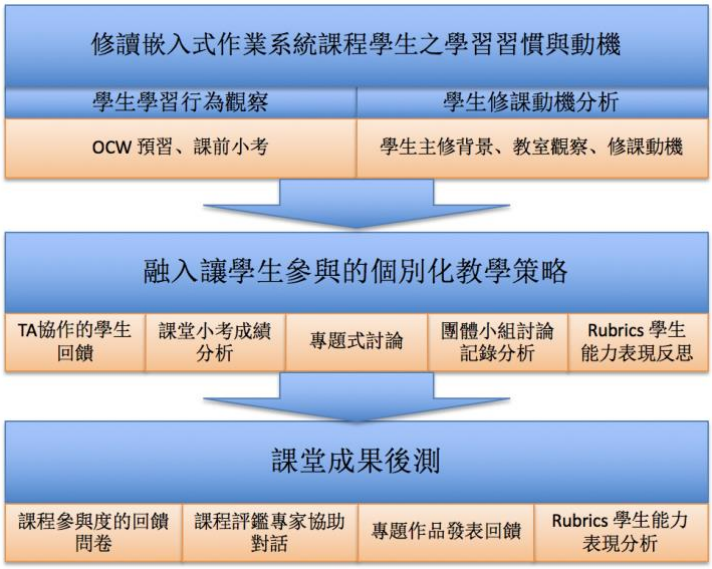
在實驗操作部分，除了實驗講解與練習外，主持人新增了「解題」，讓學生能學習分析問題，並應用所學去解決該問題。在期末專題部分，將讓學生針對所設計的專題題目分析其可行性、完成高低階設計、實作後於期末進行展演。在課堂講解、實驗操作與專題製作中將不定期給予學生形成式回饋，每學期將在期中、期末期間，利用課後時間進行較為正式的形成式評量，在掌握學生學習狀況的同時，也能拉近與學生之間的互動距離，改善課堂上的互動狀況。

主持人主要採用了四種教學方法：第一個階段是課堂講授：講授法，嵌入式作業系統的基本概念說明（理論），在課堂中進行分組鼓勵學生討論發問（採團體得分記點方式），讓師生和同學間能夠彼此溝通看見；第二階段是實驗操作（Learning by doing）：主要採示範教學法，也就是主持人與助教示範嵌入式系統開發的軟硬體協同設計，請學生進行基礎實驗操作，實務操作課程包括 5-7 個基礎實驗課程。這兩個階段或多或少都涉及「問題分析」、「資料處理」、「資源運用」及「實驗與操作」等訓練。第三個階段則是將修課學生重新分組，透過分組（學生 2-3 人一組）、助教討論及教師 formative 回饋（Rubrics）的討論等方式來進行創意專題製作，也就是專題製作教學法，讓學生深入了解作業系統的操作與基本原理。最後將其創意設計導入嵌入式開發板上，完成專題實作。另外，本教學實踐研究，重視分組助教的安排，從期初開始協助學生發展創意、完成專題設計，實現專題架構，並落實問題解決，亦即同儕教學法。最後授課教師將持續追蹤並鼓勵學生善用其課堂所學，將作業系統所提供的核心資源應用於期末專題中，降低最後成品的運作成本或提昇運作效能。

本研究評估學生成效的評量工具可以包括：1.問卷調查：問卷調查內容包括交大教務處規定的學期末課堂評量、期中問卷；2. 以面對面對話型式使用本課堂學生

能力設定 Rubrics 工具，並分析全班學生達到課堂目標的程度；3. 針對學生課堂測驗的分數分析也是本研究評估學生學習成果的重要工具，尤其學生是否熟悉知識願意投入自主學習是系統工程最重要的基礎知能；4.分析課堂進行中各組學生提問的次數，瞭解學生課堂參與度；5. 學生專題實作作品的優劣，問題解決的設計是否融入專業課堂知識，是否充分發揮團隊合作以及解決問題的能力，都是本研究計畫學生學習成效的重要評估機制。

本計畫的研究架構，主要是透過各種教學策略及方法，引導學生從「會發問」、習慣發問到產生學習熱忱的行動研究，提出符合國內嵌入式系統課程的全新個別化的課程教學模式與教學流程，突破學生對本課程的迷思，扭轉學生認為作業系統各層級的設計停留在死記硬背、作業系統是理論課程、作業系統架構已不會且無法改變等迷思。



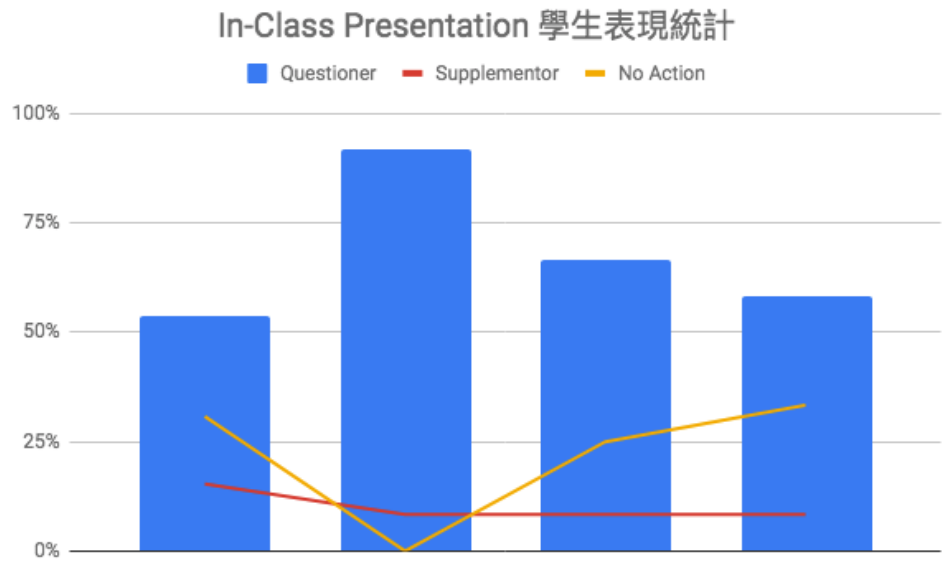
圖六、計畫研究架構

本計畫期中課堂進行時，透過 TA 確實紀錄學生發問次數及題目，另 TA 亦必須協助記錄每組學生的討論問題情況，將對各項紀錄採質性分析；主持人用來設定學生課堂專業能力的問卷也是一大重點，學生在課堂進行的兩次課堂報告，透過 Rubrics 評量工具讓主持人可以確實檢核全班學生除了考試外的學習能力表現。在課程結束後，主持人會在學期末時進行第二次學生意見「課程參與度」問卷調查，瞭解學生對整個課程設計的知覺。

5. 教學暨研究成果(Teaching and Research Outcomes)

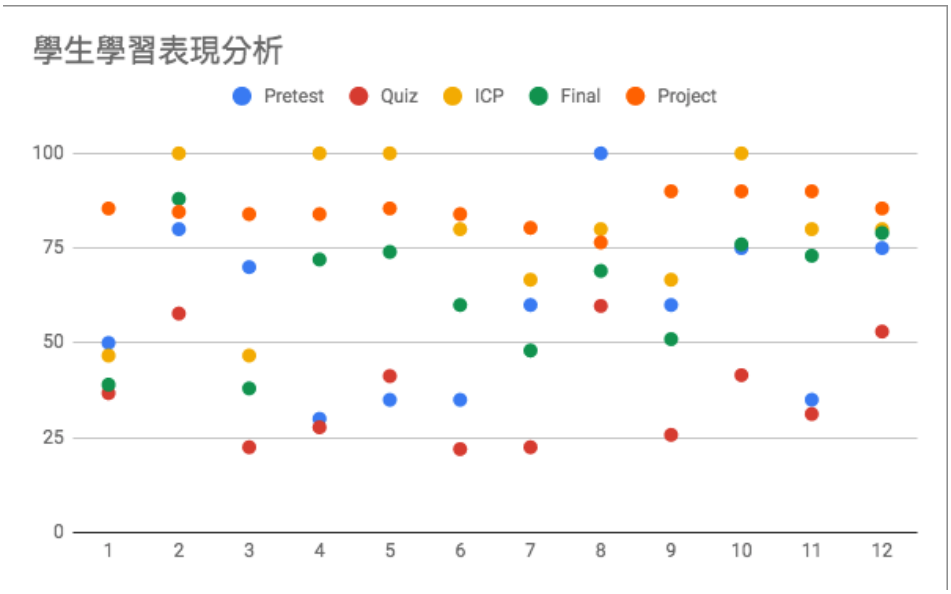
(1) 教學過程與成果

本計畫於 108 學年度上學期施作 In-Class Presentation 四次(10/18、10/25、11/22 及 11/29)。In-Class Presentation 活動有三種角色 (學生講師、提問者、助答者)。活動開始時，每次隨機挑選一位學生當講師，簡單回顧前一堂課程內容，並接受其他同學的發問。遇有講師不會的地方，他組學生可以幫忙回應 (助答者 Supplementor)。活動的進行分為兩種模式，前兩次活動 (10/18、10/25) 無時間限制，學生講師、提問者與助答者可以任意提問與回應。活動結束於無人再提問時，一般 In-Class Presentation 進行大約為一堂課時間。遇有無法回答的問題，教師 (主持人) 會介入回應說明。後兩次活動 (11/22、11/29) 則為限時提問與回應，活動進行時間為 30 分鐘。學生們 (三種角色) 需要在規定時間內提問與回應。



上圖為 108 學年度上學期 In-Class Presentation 學生表現的統計。可以發現，前兩次活動，因為沒有限制時間，學生會盡可能的提問，幫自己的團隊爭取成績；後兩次活動則因為時間限制，提問者人數變少。不論是否限制活動時間，助答者(每次都是不同的學生)人數差不多(都只有 1-2 人)。後兩次活動雖然提問者人數變少，但是提問題目較難，也因此影響到回應

時間。



另外分析 In-Class Presentation 對學生學習的影響（如上圖所示），108 上學期修課學生總數 16 名，完修及格者 12 名；學生全數為男生，來自電機資訊等科系（機器人碩士學程、電子碩、電控碩博、電機學碩博）；大學部 3 名、碩士班 7 名、博士班 2 名。圖中 X 軸代表修課學生 1 至 12（依學號排序）；藍點與紅點為學生初修課時的 Pretest 成績及期中考前的 Quiz 成績、黃點是學生 In-Class Presentation 的表現，綠點與橘點為學生期末考與期末專題的表現。由學生 2、4、6 與 10 的表現，可以看見 In-Class Presentation 表現愈優異的，期末與期初的學習變化愈大（Pretest 與 Quiz 較差、Final 進步多）。而學生 1, 3, 11 則明顯看出其 In-Class Presentation 表現較差，可能也因此影響其期末學習表現。

(2) 教師教學反思

本計畫主持人於課堂間設計並施作 In-Class Presentation 活動，透過學生與教師角色互換，讓修課學生勇於詢問學生講師（學生彼此之間有自己的

語言），希冀能透過角色互換的方式，讓台下學生勇於發問。

In-Class Presentation 的成效仰賴學生所提問題的深度，如果學生所提問題屬書本內的說明，學生講師能用其他學生所理解的語言回應之；如果學生所提問題接近產業真實問題，學生講師較無法提供正確回應、其他同學也無法助答，此時還是需要教師親自回應。

若 In-Class Presentation 的回應前類問題居多，則學生講師可以掌握大部分的回應（教師也可以從中觀察到學生講師所不懂的地方，並於之後加以說明）；若 In-Class Presentation 的回應後類問題居多，則教師需介入回應問題，因為此類問題非書本知識，部分學生會出現驚喜、頓悟的表情，教師也會很享受此間互動。

另，本計畫邀請協同主持人入堂觀課與評估學生學習成效。協同主持人反饋：「學生多數認為授課教師採用引導式教學方式，在理工課程理面不常見。但也另外表示，老師上課流程嚴謹，要求學生課前預習、課中專注、課後考試，故無論老師是否採用引導教學方式，學生認為對本課程的專注力、興趣提升影響不大。但從學生反應中得知，授課教師採用引導式的教學確實有明顯獲得學生對教師的授課滿意程度。」

(3) 學生學習回饋

本計畫收有教學反應問卷，學生反應一般良好，如下圖所列：

國立交通大學 108 學年度第 1 學期 教學反應問卷個別科目統計表

當期課號：5040　課程名稱：嵌入式作業系統(選修)　印表日期：2020/08/04 頁碼：1/2
開課班別：電控碩　任課教師：黃育綸(電機系)　問卷樣版：一般課程
修課人數：16　休退學人數：0　停修人數：3　應做問卷人數：13　答卷人數：10　填答率：76.92%(填答率若低於53.95%，表示為全校填答率之後5%)

【平均得點 / 標準差(去除極端值)】本課程：4.57 / 0.50　全校：4.45 / .34　大學部：4.31 / .36 (大學必修：4.26 / .36　大學選修：4.40 / .34)　研究所：4.52 / .33

●為提供更精確的資訊，本表亦分列填答學生的自評資料結果，以幫助教師瞭解不同學習狀況學生在各評量題項的平均點數。

一、教學反應問項得點統計：

題號	評量題項	平均點數	填答人數百分比% 非常滿意	滿意	普通	不滿意	非常不滿意	二、學生自評之平均點數 (1)認真程度 認真	一般	不認真	(2)缺席狀況 從不缺課	極少(三次內)	偶而	常常(超過1/3)	(3)自習時數 0-2小時	3-5小時	6小時以上	(4)預期成績 前1/3	中1/3	後1/3	(5)課程難易度 艱深	適中	過淺	無從判斷
1	我對教師的教學態度	4.60	60	40	0	0	0	4.83	4.25	0.00	4.63	4.50	0.00	0.00	4.33	4.60	5.00	4.50	0.00	0.00	4.67	4.57	0.00	0.00
2	我對教師的授課方法	4.50	50	50	0	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.33	4.40	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
3	我對本課程的內容與結構	4.60	60	40	0	0	0	4.83	4.25	0.00	4.63	4.50	0.00	0.00	4.33	4.60	5.00	5.00	4.50	0.00	4.67	4.57	0.00	0.00
4	我對本課程的作業、報告、考試與評分方式	4.50	50	50	0	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.33	4.40	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
	以上4題平均	4.55	55	45	0	0	0	4.83	4.13	0.00	4.57	4.50	0.00	0.00	4.33	4.50	5.00	5.00	4.44	0.00	4.67	4.50	0.00	0.00
5	**我對本課程的整體印象**	4.50	50	50	0	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.33	4.40	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
6	我覺得教師課前準備得很充足	4.30	50	30	20	0	0	4.67	3.75	0.00	4.25	4.50	0.00	0.00	4.00	4.20	5.00	5.00	4.13	0.00	4.67	4.14	0.00	0.00
7	教師上課熱忱、認真、負責	4.40	60	20	20	0	0	4.83	3.75	0.00	4.50	4.00	0.00	0.00	4.00	4.40	5.00	5.00	4.25	0.00	4.33	4.43	0.00	0.00
8	教師有按照課程綱要(目標、內容、進度、評分方式等)確實上課	4.50	60	30	10	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.00	4.60	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
9	教師的教學方法適切	4.50	60	30	10	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.00	4.60	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
10	教師授課的表達與說明清楚	4.20	50	20	30	0	0	4.67	3.50	0.00	4.25	4.00	0.00	0.00	4.00	4.00	5.00	5.00	4.00	0.00	4.33	4.14	0.00	0.00
11	教師的課堂時間分配恰當	4.50	60	30	10	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.00	4.60	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
12	本課程內容有組織、有條理	4.40	50	40	10	0	0	4.83	3.75	0.00	4.50	4.00	0.00	0.00	4.33	4.20	5.00	5.00	4.25	0.00	4.33	4.43	0.00	0.00
13	使用之教科書、教材或講義對學習很有幫助	4.60	60	40	0	0	0	4.83	4.25	0.00	4.63	4.50	0.00	0.00	4.67	4.40	5.00	5.00	4.50	0.00	4.67	4.57	0.00	0.00
14	教師教授的教材內容充實豐富	4.40	50	40	10	0	0	4.83	3.75	0.00	4.50	4.00	0.00	0.00	4.33	4.20	5.00	5.00	4.25	0.00	4.33	4.43	0.00	0.00
15	考試、作業或報告的內容對學習很有幫助	4.50	50	50	0	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.33	4.40	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
16	考核與評分的方式公平合理	4.30	50	30	20	0	0	4.67	3.75	0.00	4.25	4.50	0.00	0.00	4.33	4.00	5.00	5.00	4.13	0.00	4.67	4.14	0.00	0.00
17	我可以很容易在教師的office hours或**是利用其他**方式與教師**聯絡**	4.50	50	50	0	0	0	4.83	4.00	0.00	4.50	4.50	0.00	0.00	4.33	4.40	5.00	5.00	4.38	0.00	4.67	4.43	0.00	0.00
	答卷人數中，學生自評之各面向回答人數		6	4	0	8	2	0	0	3	5	2	2	8	0	3	7	0	0				

國立交通大學 108 學年度第 1 學期 教學反應問卷個別科目統計表

當期課號：5040　課程名稱：嵌入式作業系統(選修)　印表日期：2020/08/04 頁碼：2/2
開課班別：電控碩　任課教師：黃育綸(電機系)　問卷樣版：一般課程
修課人數：16　休退學人數：0　停修人數：3　應做問卷人數：13　答卷人數：10　填答率：76.92%(填答率若低於53.95%，表示為全校填答率之後5%)

三、學生對課程或授課老師的建議：依據＜二、學生自評之認真程度＞排序：

・認真程度：認真
1 教得很好
・認真程度：一般
2 希望講義可以有圖片

本計畫另設計 Rubrics 表格，透過教師與學生 1-1 訪談，讓教師更能夠掌握學生學習狀況。本訪談於開學後第四週進行，由教師詢問學生三個問題(下表之 Q1、Q2、Q3),學生自評自己對該主題的理解度(下表之 Student 列), 同時教師也依據學生回應評估學生的理解度(下表之 Teacher 列)。下表為教師與學生針對各問題理解度的評估差異：

Q1	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Student	3	1	1	2	1	3	1	1	1	1	1	1
Teacher	3	1	1	1	1	3	1	1	1	1	1	1
Q2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Student	3	2	2	2	1	1	1	1	2	2	2	2
Teacher	3	1	2	2	1	2	1	1	2	2	1	2
Q3	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Student	2	3	3	2	1	3	1	2	2	1	1	2
Teacher	3	3	3	2	1	2	2	2	2	2	1	1

有四個題次教師評估分數低於學生自評（黃底標示）、四個題次學生認為

自己尚未掌握該問題之核心（藍底標示）。透過此教學訪談，除了讓教師與學生能瞭解自己的學習狀態外，也可以拉近教師與學生之間的距離。教師在訪談中與學生交流如何學好該門課，學生也於訪談時反饋教師教學建議。整體而言，學生於訪談後變得跟教師比較熟稔，課間或課後的提問頻率有提昇。

6. 建議與省思(Recommendations and Reflections)

本計畫讓教師有機會得以在課堂中透過教學的行動研究，重新從學生的角度思考自己的教學缺點，例如，從學生在 In-Class Presentation 中可以覺察學生對基礎原理的掌握度、對新興科技的探索慾等等。另外，本計畫所採用之 formative 評估方式，透過 1-1 訪談，讓學生與教師都更能掌握過去幾堂課的所學成效，教師在訪談中與學生交流如何學好該門課，學生也於訪談時反饋教師教學建議。

不過，訪談前務必要跟學生說明清楚該訪談不計分，否則遇到分數導向的學生時，他們因為不敢錯答，僅會提到書本上的說明，而不敢更深入的去討論與該題目有關的資訊或提問。一旦跟學生說明此訪談不計分，學生會比較放得開，並反饋教師教學改進建議。

教學實踐計畫立意佳，讓教師有機會在自己的課堂上留意學生的學習反應，尤其是透過 1-1 訪談，可以拉近師生距離，教師也比較能夠掌握個別學生的個性與學習不足之處。只是，1-1 訪談僅能由教師親自執行，耗力耗時，不是個輕鬆的行動研究。

二. 參考文獻(References)

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Zha, Jianzhong (2008). On CDIO Model under "Learning by Doing" Strategy. Research in Higher Education of Engineering, 2008-03.

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三. 附件(Appendix)

與本研究計畫相關之研究成果資料，可補充於附件，如學生評量工具、訪談問題等等。

以下附件為本計畫 1-1 訪談資料。使用 Rubric 表格評估學生前幾週的學習成效，左上角標示 student 者為學生自評資料、其他則為教師評估資料。

Student

EOS 2019 Fall

Student ID (last 4 digits): 0706

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

Teacher

EOS 2019 Fall

Student ID (last 4 digits): 0706

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

Student

EOS 2019 Fall

Student ID (last 4 digits): 0295

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

Teacher

EOS 2019 Fall

Student ID (last 4 digits): 0295

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

student

EOS 2019 Fall

Student ID (last 4 digits): 6007

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

Teacher

EOS 2019 Fall

Student ID (last 4 digits): 6007

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0013

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0013

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

W1 請假.

EOS 2019 Fall

Student ID (last 4 digits): 0789.

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0789

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0728

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems ✓	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution ✓
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process. ✓	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0728

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 1917

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model ✓
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution ✓
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. ✓ • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 1917

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0822

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0822

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall Student ID (last 4 digits): 0038

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0038

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0814

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0814

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0074

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0074

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall Student ID (last 4 digits): 0749

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands

EOS 2019 Fall

Student ID (last 4 digits): 0749

Learning Outcome	Excellent	Basic	Poor
codesign model	• Understand the process of codesign model: why and how • Understand the detail of the codesign process of embedded systems	• Understand the process of codesign model: why and how	• Partially understand the process of codesign model
Software Development	• Fully understand the development process • Can explain what is a symbol table and its applications • Can explain the difference of symbol resolution and relocation	• Understand the process: compilation, link, load, and execution • Can explain what is a symbol table	• Understand the process: compilation, link, load, and execution
Hands-on Practices (Lab 1 & 2)	• Understand the environment setup for both practices and can extend the model to other development platforms. • Understand all commands and can use the commands properly. • Understand the characteristics of fsbl and u-boot. • Understand the whole booting process.	• Understand the environment setup for one or two practices • Understand 3 or more commands • Understand what SDK should be used in the practices • Understand the difference between root filesystem and kernel images	• Understand the environment setup for one or less practice. • Not familiar with commands