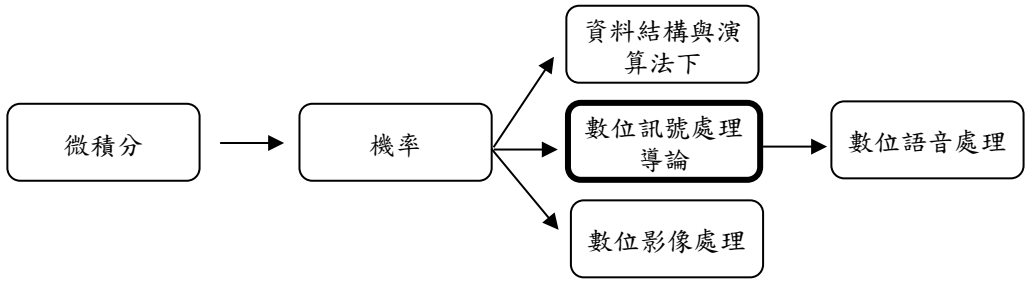
國立臺灣大學資訊工程學系教學大綱表

						適用學期	
課程名稱	中文：數位訊號處理導論 英文：INTRODUCTION TO DIGITAL SIGNAL PROCESSING					授課教師	吳家麟
學分數	3	必/選修	選修	開課年級		課　　號	922 U1020
課程關係							
課程概述	Along with great growing of the development of computer processor, memory space and speed-up of networking communications, digital multimedia technologies are flourishing dramatically recently. Digital signal processing (DSP) is one of the technologies and is prevalent nowadays in a very wide variety of applications such as telephony, radar, sonar, audio, digital TV, digital multimedia (speech and image/video processing) and diversified consumer electronic devices like mobile phones, personal digital assistant (PDA), computer, portable music player (PMP), etc. The emphasis of this course will be focused on the theories and applications for discrete-time signals and systems. Through the designed projects and hands-on experiments based on MATLAB, students will be able to clarify complicated mathematical concepts and realize the physical meaning behind the equations. The prerequisites of this course include linear algebra, transform theory, and probability.						
課程目標	本課程的目標在於讓修課同學： ● Build up a solid background of mathematics adopted in signal processing ● Know both discrete- and continuous-time signals and systems ● Understand linear filtering, amplitude modulation, sampling theorem, discrete-time filtering and spectrum analysis ● Be familiar with the programming language useful for signal processing ● Be able to associate the knowledge of DSP theories with real-life applications						

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單元主題	內容綱要	預估週數	備　註
Introduction to discrete linear systems	● Discrete time signals ● Special sequences ● Shift invariance ● Stability and causality	1.5	
Characterization of discrete time systems	● Difference equations ● Impulse response ● System function	1.5	

	● Frequency response – Fourier transforms		
The Z transform	● Definition of the Z transform ● Region of convergence (ROC) ● Properties of ROC and the Z transform ● Inverse Z transform	1	
Examples of digital filters	● Averaging filter ● Recursive smoother ● First-order notch filter ● Second-order unity gain resonator ● All-pass filters ● Comb filters ● Equalization filters	1	
Discrete-time Fourier transforms	● Fourier series ● Continuous-time Fourier transforms ● Discrete-time Fourier transforms ● Discrete Fourier transforms	1	
Sampling	● Sampling continuous-time signals: the sampling theorem ● Aliasing ● Re-sampling digital signals ● A/D conversion and quantization ● D/A conversion	2	
The discrete Fourier transform	● Definition of DFT and relation to Z transform ● Properties of the DFT ● Linear and periodic convolution using the DFT ● Zero padding, spectral leakage, resolution and windowing in the DFT	1.5	
The fast Fourier transform	● Decimation in time FFT ● Decimation in frequency FFT	1	
Finite impulse response (FIR) filters	● Window design techniques ● Kaiser window design technique ● Equi-ripple approximations	0.5	
Infinite impulse response (IIR) filters	● Bilinear transform method ● Examples of bilinear transform method	1.5	
Structures and properties of FIR and IIR filters	● IIR – direct, parallel and cascaded realizations ● Minimum phase IIR filters ● FIR – direct and cascaded realizations ● Linear phase FIR filters ● Coefficient quantization effects in digital filters	2.5	
教學要點概述 / 教材編選	教科書：A. Oppenheim and R. Schafer, *Discrete-Time Signal Processing*, Prentice Hall, 2nd Ed., 1999		
	參考書： J. Proakis and D. Manolakis, *Digital Signal Processing: Principles, Algorithms and Applications*, Prentice Hall,		

		1995 B. Porat, *A Course in Digital Signal Processing*, J. Wiley and Sons, 1996 V. K. Ingle and J. G. Proakis, *Digital Signal Processing: Using MATLAB*, Brooks/Cole Pub. Co., 1999
		課程網頁：www.csie.ntu.edu.tw/~dsp
		■自行製作 □教科書商提供 □其它：
	教學方法	■投影片 ■板書 □實習/實驗 □其它：
	評量方式	■考試 ■作業 □報告 □其它：
	教學資源	■單槍投影機 ■一般投影機 □白板 ■黑板 ■一般教室 □實驗室 □其它:
	其他事項	
課程目標與教育核心能力相關性		■ G1. 活用資訊、數學、及科學知識之能力。 Digital signal processing requires mathematical background of linear algebra, transform theory and probability. Students are supposed to be apply those knowledge flexibly to deal with problems through the course
		■ G2. 具有資訊理論、硬體、軟體與應用之專業知識，並至少專精其中之一。 Students are challenged with simplified real-world problems which require them to be familiar with DSP theories and MATLAB programming skills
		□ G3. 能分析、設計、實作、整合、測試、與評估資訊系統。 (假如相關，請敘明)
		□ G4. 具備與跨領域團隊合作溝通之能力，並能領導與管理團隊。 (假如相關，請敘明)
		□ G5. 具備論文閱讀與檢索文獻之能力。 (假如相關，請敘明)
		■ G6. 策劃及執行研究計畫，並具備論文撰寫與科技簡報之能力。 For the course projects, students are asked to write reports based on the MATLAB experimental results which include methodology and discussion
		■ G7. 具備創新思考、獨立研究、及解決問題之能力。 All the homework assignments are individual work. Through out those exercises, students are trained to deliberate and solve the assigned problems by themselves
		□ G8. 能分析評估資訊產業脈動與最新之科技進展。 (假如相關，請敘明)
		□ G9. 促進資訊科技對於社會、教育、經濟、文化等的影響。 (假如相關，請敘明)
		□ G10. 具備自我提升以面對全球快速的變化的能力。 (假如相關，請敘明)
		■ G11. 尊重學術、工程倫理、及智慧財產權。 Plagiarism is strictly prohibited. Students have to be aware of moral principles and respecting other peoples' intellectual property rights