

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	高级仪器系统的研发 I Advanced Instrumentation Systems I
2.	授课院系 Originating Department	化学系 Department of Chemistry
3.	课程编号 Course Code	CH212-16
4.	课程学分 Credit Value	4
5.	课程类别 Course Type	专业选修课 Major Elective Courses
6.	授课学期 Semester	春季 Spring
7.	授课语言 Teaching Language	英文 English
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	刘重阳, 化学系, 办公室: 第一科研楼 432; 办公电话: 88018313; 电子邮件: liucy@sustech.edu.cn Chongyang Liu Department of Chemistry Phone: 88018313; Email: liucy@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	无 NA
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	Total
学时数 Credit Hours	32		64		96

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	化学原理 A (CH101A)
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	高级仪器系统的研发 II (CH307-13)
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 NA

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

培养学生独立设计和搭建从事前沿科学研究所需的仪器测试系统。

Instrumentation is the art and science of measurement and control of process variables. A system is a set of devices that are connected to act as one complete unit. Advanced instrumentation systems use a programming language (LabVIEW in this course) to integrate multiple systems in order to bring information from the outside world into a computer, make decisions based on the acquired data, and send computed results back into the world to regulate the way an instrument operates. LabVIEW is an easy-to-use graphical programming language; its intuitive user interface makes writing and using programs simple, exciting, and fun.

Success in frontier research often requires advanced instrumentation systems that may not be commercially available. Elaborately designed and assembled instrumentation systems can offer great flexibility, precise synchronization, and sophisticated control in the operation. In this course, students will learn some instrumentation skills including LabVIEW programming, computer interfacing, data acquisition, and instrument control. This course will be graded on the basis of homework and group projects.

16. 预达学习成果 Learning Outcomes

能够用计算机控制仪器。

Students will gain basic instrumentation skills including LabVIEW programming, computer interfacing, data acquisition, and instrument control.

17. 课程内容及教学日历 (如授课语言以英文为主, 则课程内容介绍可以用英文; 如团队教学或模块教学, 教学日历须注明主讲人)

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition

By Jeffrey Travis, Jim Kring (14 weeks)

Chapter 1. What in the World Is LabVIEW?

Overview

Key Terms

What Exactly Is LabVIEW, and What Can It Do for Me?

Demonstration Examples

Chapter 2. Virtual Instrumentation: Hooking Your Computer Up to the Real World

Overview

Key Terms

Using LabVIEW in the Real World

The Evolution of LabVIEW

What Is Data Acquisition?

What Is GPIB?

Communication Using the Serial Port

Real-World Applications: Why We Analyze

A Little Bit About PXI and VXI

Connectivity

LabVIEW Add-on Toolkits

LabVIEW Real-Time, FPGA, PDA, and Embedded

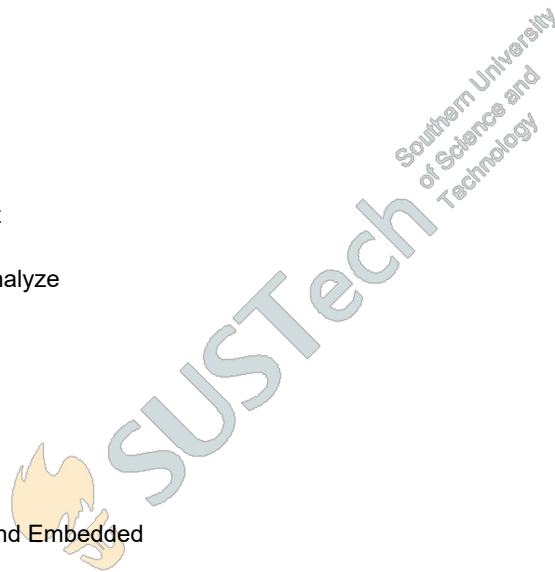
Chapter 3. The LabVIEW Environment

Overview

Key Terms

Front Panels

Block Diagrams



LabVIEW Projects

SubVIs, the Icon, and the Connector

Activity 3-1: Getting Started

Alignment Grid

Pull-Down Menus

Floating Palettes

The Toolbar

Pop-Up Menus

Help!

Express VIs

Displaying SubVIs as Expandable Nodes

A Word About SubVIs

Activity 3-2: Front Panel and Block Diagram Basics

Chapter 4. LabVIEW Foundations

Overview

Key Terms

Creating VIs: It's Your Turn Now!

Activity 4-1: Editing Practice

Basic Controls and Indicators and the Fun Stuff They Do

Wiring Up

Running Your VI

Useful Tips

Wrap It Up!

Additional Activities

Chapter 5. Yet More Foundations

Overview



Key Terms

Loading and Saving VIs

Debugging Techniques

Activity 5-1: Debugging Challenge

Creating SubVIs

Documenting Your Work

A Little About Printing

Activity 5-2: Creating SubVIs Practice Makes Perfect

Wrap It Up!

Additional Activities

Chapter 6. Controlling Program Execution with Structures

Overview

Key Terms

Two Loops

Shift Registers

The Case Structure

Dialogs

The Sequence Structure Flat or Stacked

Timing

The Timed Structures

The Formula Node

The Expression Node

The While Loop + Case Structure Combination

Wrap It Up!

Additional Activities

Chapter 7. LabVIEW's Composite Data: Arrays and Clusters



Overview

Key Terms

What Are Arrays?

Creating Array Controls and Indicators

Using Auto-Indexing

Two-Dimensional Arrays

Activity 7-1: Building Arrays with Auto-Indexing

Functions for Manipulating Arrays

Activity 7-2: Array Acrobatics

Polymorphism

Activity 7-3: Polymorphism

Compound Arithmetic

All About Clusters

Interchangeable Arrays and Clusters

Error Clusters and Error-Handling Functions

Wrap It Up!

Additional Activities

Chapter 8. LabVIEW's Exciting Visual Displays: Charts and Graphs

Overview

Key Terms

Waveform Charts

Activity 8-1: Temperature Monitor

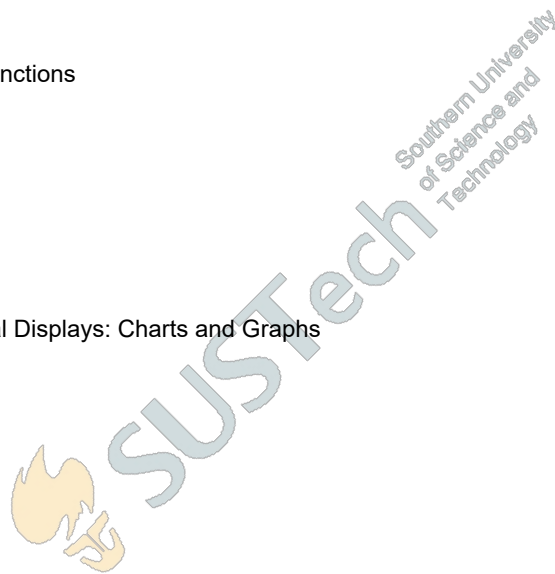
Graphs

Activity 8-2: Graphing a Sine on a Waveform Graph

XY Graphs

Chart and Graph Components

Activity 8-3: Using an XY Graph to Plot a Circle



Activity 8-4: Temperature Analysis

Intensity Charts and GraphsColor as a Third Dimension

Time Stamps, Waveforms, and Dynamic Data

Mixed Signal Graphs

Exporting Images of Charts and Graphs

Wrap It Up!

Additional Activities

Chapter 9. Exploring Strings and File I/O

Overview

Key Terms

More About Strings

Using String Functions

Activity 9-1: String Construction

Parsing Functions

Activity 9-2: More String Parsing

File Input/Output

Wrap It Up!

Additional Activities

Chapter 10. Signal Measurement and Generation: Data Acquisition

Overview

Key Terms

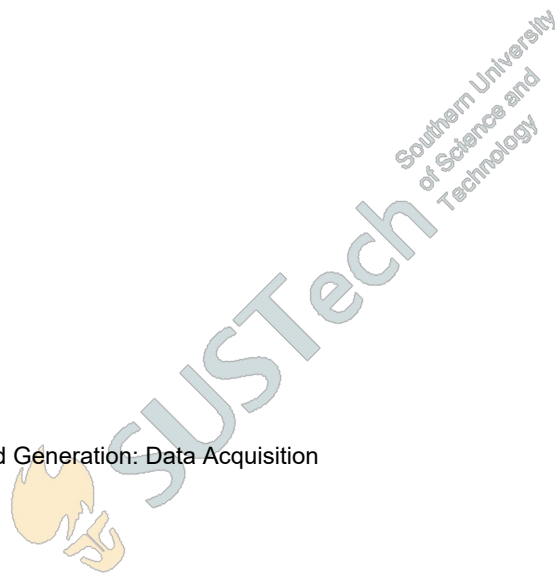
DAQ and Other Data Acquisition Acronyms

How to Connect Your Computer to the Real World

Signals 101

Selecting and Configuring DAQ Measurement Hardware

Wrap It Up!



Solutions to Activities

Chapter 11. Data Acquisition in LabVIEW

Overview

Key Terms

Understanding Analog and Digital I/O

NI-DAQmx Tasks

Advanced Data Acquisition

Chapter 12. Instrument Control in LabVIEW

Overview

Key Terms

Instrumentation Acronyms

Connecting Your Computer to Instruments

SCPI, the Language of Instruments

VISA: Your Passport to Instrument Communication

Instrument Control in LabVIEW

Chapter 13. Advanced LabVIEW Structures and Functions

Overview

Key Terms

Local, Global, and Shared Variables

Property Nodes

Invoke Nodes

Event-Driven Programming: The Event Structure

Type Definitions

The State Machine and Queued Message Handler

Messaging and Synchronization



SUSTech
Southern University
of Science and
Technology

Structures for Disabling Code

Halting VI and Application Execution

Cool GUI Stuff: Look What I Can Do!

Chapter 14. Advanced LabVIEW Data Concepts

Overview

Key Terms

Project:

1. Write a LabVIEW program to control an electronic instrument in data acquisition (3 to 4 weeks);
2. Write a LabVIEW program to control a nanomanipulator (3 to 4 weeks).

18. 教材及其它参考资料 Textbook and Supplementary Readings

1. LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition, by Jeffrey Travis, Jim Kring
2. LabVIEW based Advanced Instrumentation Systems by S. Sumathi , P. Surekha
3. LabVIEW for Engineers by Ronald W. Larsen
4. Instrumentation and Control Systems by W. Bolton
5. Instrumentation Reference Book, Fourth Edition, Edited by Walt Boyes

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance				
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		80		
平时作业 Assignments		20		
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final				

Presentation

其它（可根据需要
改写以上评估方
式）

**Others (The
above may be
modified as
necessary)**

20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**
 B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过

This Course has been approved by the following person or committee of authority

化学系教学指导委员会
Teaching committee of the chemistry department

