ECI (EN-3212)- Electronics (& Computer Integration)

Electronics - SPRING 2025 (STCW)

ECI provides a broad overview of the modern electronics used by the marine and power industries for automation, system monitoring and control. Electronic components and circuits are categorized by function (sensor, transmitter, actuator or controller), signal type (analog or digital), and technology (i.e., computer, micro-electronic, solid-state).

Engineering Learning Outcomes:

1. Understand the relationship of component blocks and signals in electronic systems.
2. Define and analyze circuits and components used for analog signals and conditioning.
3. Define and analyze circuits and components used for digital signals and conditioning.
4. Read analog and digital circuit diagrams, and identify basic electronic components.
5. Use solid-state devices (Op-Amps) for both amplification and switching applications.
6. Read and understand PLC and ladder logic circuits used in discrete-state applications.

STCW Demonstrated Knowledge, Understanding & Proficiency:

OICEW-B1.2 Configuration and operation principles of electronic equipment
OICEW-B1.2 Characteristics of basic electronic circuit elements
OICEW-B2.6 The interpretation of electrical and simple electronic diagrams

Text: **Process Control Instrumentation Technology**
Curtis D. Johnson, 8th Edition (© 2006), Prentice Hall

Instructor: Dr. John J. Bausch Phone: (508) 830-5000 (x-2029)
Email: jbausch@maritime.edu Room: HA-222

Email & Calendar: Check your email **DAILY for electronic assignments**, additional information, and the Electronics Lecture FOLDER (see email for @Google Drive):

Class: Monday, Wednesday, and Friday
Section x12 = @0900 (2nd period) Room = The ELab @BR-222

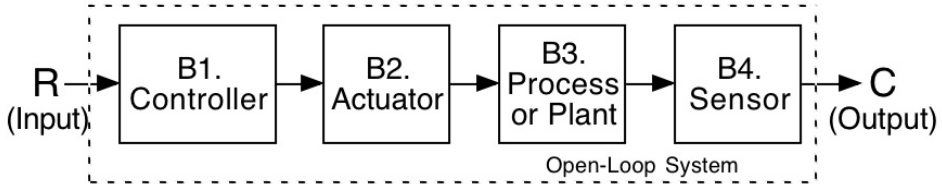
Grading: Based on homework, quizzes, & exams. The 2-hr Final Exam is **mandatory.** Classroom Policy is based-on the **Regimental Manual**; **NO FOOD or DRINK allowed. Late work will NOT be accepted. ATTENDANCE is mandatory** and is tracked to satisfy STCW requirements; Unexcused Absents will result in a Grade Reduction.
STCW Requirements: A minimum grade of **C- (70 out of 100)** is needed to **PASS**

Evaluation: Exam problems & questions are primarily based on homework & quizzes.

Homework (~weekly)	5%
iClicker Feedback (~daily)	5%
Quizzes (any time baby)	20%
Exam1	20%
Exam2	20%
Final (2 hour Comprehensive)	30%
Total Grade	100%

ECI- Electronics & Computer Integration

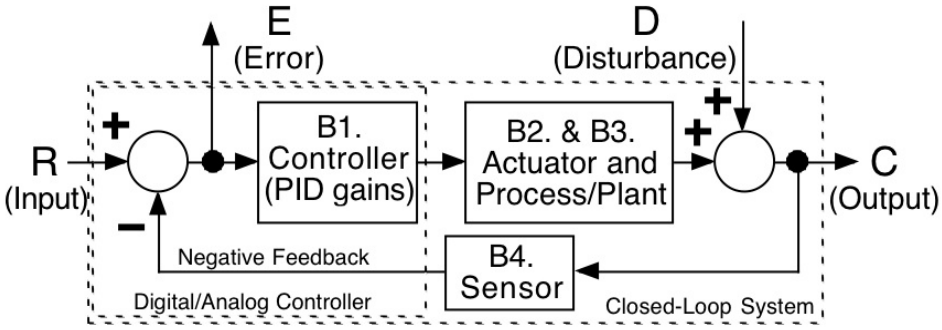
ECI now uses the textbook previously used for Instrumentation & Control: Curtis Johnson's "Process Control Instrumentation Technology". Using the first eight chapters, students are exposed to most of the electronic hardware components and systems in use in both analog and digital worlds. The C-A-P-S diagram below is used to introduce students to the concept of block-diagram systems, and the input/ output relationships of most industrial electronic components. Electronic hardware components are defined first by electronic function as one of the following: 1) a Controller, 2) an Actuator, or 3) a Sensor, as related to a Process, Plant or system.



ECI-Electronics: The C-A-P-S Model; the open-loop Block Diagram that defines major components of Electronic Hardware, and the relationship between the electrical signals.

INC (EN-4223)- Instrumentation & Controls

Modern digital controllers are primarily implemented in software and require more advanced dynamic system models; real-time signals are integrated through programs like Matlab/Simulink (introduced in INC) using C-language-like .m files. The INC class takes the component block diagram from ECI (shown above), and adds the complexity of a closed-loop, multi-input, multi-output, PID controller (shown below). In this case, the system dynamics are essential to design, and the INC class introduces controller performance parameters based on:
1) Stability, 2) Speed of Response, and 3) Dynamic Accuracy.



INC-Controls: The Closed-loop Block Diagram for Instrumentation & Controls. INC uses transfer functions to study the more advanced concepts of dynamic modeling and multi-input, multi-output, proportional-integral-derivative (PID) control systems.

ECI-2010 SAMPLE Schedule-NOT ACTUAL!!!

(The real-time electronic schedule, is sent via email)

NOTE: This is Not the ACTUAL Syllabus. Check your EMAIL for UPDATES!

L1: Welcome to ECI
L2: Intro to Marine Electronics
L3: Electronic Control Applications
L4: Intro to Control & Monitoring Systems
L5: Control System Performance (Signals)
L6: Digital & Analog Systems
L7: Levels & Types of System Electronics
L8: Measurement Units & Error
L9: Error, Accuracy & Uncertainty
L10: Sensors & System Dynamics
L11: Intro to Analog Signal Processing
L12: Filtering & Impedance
L13: Voltage Dividers & Bridges
L14: RC (Analog) Filters
L15: RC Filter Design
L16: Exam1
L17: 1st Order & 2nd Order Hi-Pass Filters
L18: Advanced RC Filter Design
L19: Filter Design with Op-Amps
L20: Transistors & Solid-State Relays
L21: Intro to Operational Amplifiers
L22: Op-Amp Electronic Circuits
L23: Op-Amp Electronic Applications
L24: Intro to Digital Signal Processing
L25: Switching Theory, Logic Gates & Boolean Logic
L26: Computers Bus Systems, TTL Voltages & Digital I/O
L27: Digital Electronics & Devices (Comparators)
L28: Digital to Analog Converters (DACs)
L29: Analog to Digital Converters (ADCs)
L30: Exam2
L31: Guest Lecture: Mr. Tom Quinn from Rolls Royce Marine
L32: Electronic Logic Systems & Boolean Algebra
L33: Ladder Logic Systems & Application Design
L34: E-M Relay, Timer & Counter Applications
L35: Cargo Elevator Application Case Study
L36: Intro to Digital PLCs (Programmable Logic Controllers)
L37: PLC Programming Application & DEMOs
L38: ECI Course Review
L39: Final Exam

Problem Set #1:
ECI-PSet1-Block Diagrams & I/O Signals
DUE DATE = _____
TURN in a HARD COPY at the start of class (to the Blue Box).

Reading: Chapter 1 in Johnson (Sections 1.1-1.4)
PAGE Through the Entire Textbook to get a "feel" for the information inside.

REVIEW the ECI-Electronics Course NOTES & VideoLogs (VLogs):
https://drive.google.com/drive/u/0/folders/1yiFYYQN_thpgQHua30FM6B7av2QzBySc

REVIEW the G.Drive Lecture#01 Course NOTES & POSTS:
https://drive.google.com/drive/u/0/folders/1l7jKZEd9Z8z5oQOTT5pfX17cL3bcrFlV

BUY & BRING an iCLICKER (to Each and EVERY Class):
https://www.amazon.com/iclicker-student-remote-i-clicker/dp/149860305X/ref=sr_1_1?ie=UTF8&qid=1520278153&sr=8-1&keywords=iclicker+plus
iclicker+ student remote @Amazon

BUY & USE the PCIT TEXTBOOK (homework & independent study):
https://www.amazon.com/Process-Control-Instrumentation-Technology-8th/dp/8120330293/ref=pd_lpo_sbs_14_t_0?_encoding=UTF8&psc=1&refRID=4CPFKQ1EE91YNZG0BJX1
Process Control Instrumentation Technology 8th Edition @Amazon

PSet#1 (of 9) = 7-PCIT Textbook Problems:

1.1- A/C System, Block Diagram

1.2- Auto Driving Control
Is this open-loop or closed-loop?
What are the sensors?

1.3- Refer Madness. Chill out with another Block Diagram.

1.4- Control Performance Criteria: Max Error and Settling Time

1.5- System Tuning

1.6- Quarter Amplitude Criterion

1.7- Quarter Amplitude Criterion again

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