

**SLOT MACHINE PRINCIPLES I ET 238B**  
**Computing & Engineering Technology Department**  
**Fall 2008**

**COURSE NUMBER:** ET 238B                      **CALL NUMBER:** 45819  
**COURSE TITLE:** Slot Machine Principles I  
**SECTION:** CY001                      **CREDITS:** 4 (3,3,0,0)  
**PREREQUISITES:** ET 131B, ET 212B  
**TIME:** Monday and Wednesday 6:00 PM to 8:50 PM, Room 2739  
**INSTRUCTOR:** Joe Miller  
**TEXT: TBA**                      **OTHER REQUIRED MATERIALS: TBA**  
**OFFICE NUMBER:** 2716                      **PHONE:** 651-4157  
**E-mail:** [joseph.miller@csn.edu](mailto:joseph.miller@csn.edu)                      **WEB:** <http://sites.csn.edu/jmiller>  
**OFFICE HOURS:** Per Web Page

**COURSE DESCRIPTION:**

An introductory course in the design, theory, operation, maintenance and support of electronic slot machines.

**SAFETY:** The electronics technician works with electrical and electronic devices. Test instruments are used to measure the electrical characteristics of these components and their respective circuits. There are many tasks that are involved with the technicians work. Even though these tasks are interesting and challenging, they may involve certain hazards if the technician is careless concerning work habits. It is essential that every student learn and practice the principles of safety.

"The primary safety rule for general shop and the electronics laboratory is: **THINK BEFORE YOU ACT - DON'T CLOWN AROUND!** Safety is everyone's responsibility. Everyone must cooperate to create the safest possible working conditions."

**GENERAL LABORATORY SAFETY PROCEDURES:**

- **NO SMOKING** in the building - **Nevada State Law.**
- **Keep desks and work benches** in a **neat and orderly** fashion.
- Extraneous items of jewelry should be **removed** before applying power to a circuit. This includes **ALL rings and ALL watches.**
- **No food or beverages** will be allowed near work stations or machines.
- **Keep aisles clear.** Keep doors and drawers closed after obtaining necessary materials. **Inspect** the work station for safety hazards. Inspect test leads and hook-up wires for cuts, nicks, and exposed wire. Inform the instructor or lab assistant of any hazards that are found.
  
- Your instructor will inform you of additional safety rules that must be adhered to.

**ELECTROSTATIC DISCHARGE (ESD):** ESD is a problem all technicians and engineers must be made aware of. All bench work will be accomplished at ESD protected work stations.

**DISABILITIES:** If you have a documented Disability that may require assistance, you will need to contact the Disability Resource Center (DRC) for coordination of your Academic Accommodations. The phone numbers for each DRC office are: West Charleston 651-5644, Cheyenne 651-4045, and Henderson 651-3795.

For those students that would like to earn a little extra cash, stop by the DRC to fill out a job interest card. This office hires students as note takers, proctors, scribes, and research assistants as needed.

**RETENTION:** Helping you survive and succeed in college is what Retention is all about. Did you know that CCSN has a wide array of services and programs to help make your experience at CCSN be a successful and rewarding one? The office of Retention can help you get or stay on the right track. We offer:

- **Coyote Student Coaches** offer **free tutoring** on a walk-up basis during posted hours in many subjects.
- **E-ALERT!** Is CCSN's academic early warning system. Professors identify students who need help and/or students who are having trouble in their classes may set up an appointment and receive help.
- **Free Success Planning Appointments** are available. The staff of the Retention Office is committed to helping you succeed at CCSN by sitting down with you, assessing your needs and getting you plugged in to CCSN's many resources.

**GRADING SCALE:**

A: 90 -100%, B: 80 - 89%, C: 70 - 79%, D: 60 - 69%, F: <60%

**The final grade will be based upon:** Quizzes: 15%, Design Project: 15 %, Lab Performance: 15%, Midterm: 25 %, Final Exam: 25%, Participation 5%.

**Lab.** Lab groups will consist of at least 2, but not more than three students. For each Lab the group will turn in just one report and it is due at the start of class one week from the scheduled lab completion. The report will follow the Lab report guidelines that will be handed out before the first Lab is performed.

**Attendance Policy:** College enrollment assumes maturity and seriousness of purpose. Students are expected to attend each meeting of every course for which they have registered. A student may be administratively dropped from a course for excessive absences upon recommendation of the course instructor and written approval of the Assistant Dean. Under no circumstances will an absence, for any reason, excuse the student from completing all works assigned in a given course. After an absence, it is the student's responsibility to check with the instructor about completion of missed assignments.

**Course Content:**

1. Slot Machine Components
9. Legacy items: Coin Comparators & Hoppers

- |                                |                                    |
|--------------------------------|------------------------------------|
| 2. Machine Styles              | 10. Reel Motors and Mechanisms     |
| 3. Block Diagram               | 11. LCD & CRT Displays             |
| 4. Modes of Operation          | 12. Statistical Recall             |
| 5. RAMs and ROMs               | 13. Troubleshooting                |
| 6. Embedded Microprocessors    | 14. Casino Management Systems      |
| 7. Random Number Generators    | 15. Player Tracking Systems        |
| 8. Dollar Bill Validator (DBV) | 16. Schematic Reading and Analysis |

### **COURSE OUTCOMES:**

At the completion of the course, the student will be able to:

1. Demonstrate a working knowledge of embedded microprocessor systems.
2. Explain the difference between ROM, PROM, EPROM, RAM, and Flash
3. Identify electronic circuits used in slot machines.
4. Explain the theory of operation of a typical electronic slot machine.
5. Describe the modes of operation of a slot machine.
6. Demonstrate a working knowledge of Pseudo Random Number Generators.
7. For legacy systems, explain the coin-in and coin-out (hoppers) assemblies
8. Identify external and internal components.
9. Show proper ESD prevention.
10. Demonstrate proper safety precautions.
11. Describe the operation of peripheral devices.
12. Demonstrate proper troubleshooting and diagnostic procedures.
13. Interpret slot machine schematics.

### **WEEKLY TOPICS AND HOMEWORK SCHEDULE:**

Mon Aug 25: Introduction to course

**I. Safety:** Read Appendix C before next week

**II. ESD:** Read Appendix B before next week

**III.** Glossary

**IV.** History of gaming machines

**V.** Machine styles

1.1.1.3

Slant top

Round top

Upright

Bar top (Flat top)

Wed Aug 27: Quiz 1(Safety, history & styles of gaming machines, and ESD)

**I. Types of gaming machines**

**1.1.1.2**

Machine components

Types of games

**II.** Manufacturers of gaming devices (web sites)

1.1.1.8

**III.** Block diagram and theory of operation

2.1.1.1

**IV.** Modes of Operation

M Sep 1: **Holiday**

W Sep 3: Quiz 2 (Components, manufacturers, Modes of operation, Block Diagram and types)

- I. Embedded microprocessors (Pin-outs, ALE, etc -2.1.1.6)
- II.** Micro controllers
- III.** Memory devices 3.1.1.1 - 5.1.1.6

**Read before class:** What is a Micro Controller Chapters – see the link on the learning module

- M Sep 8:     **LAB Basic Stamp Familiarization** (New)
- W Sep10:    ~~Quiz 3 (Microprocessors, memory, and microcontrollers)~~  
**Peripherals** **6.1.1.1**  
     **I.** Coin Comparators (CC-16 schematic)  
     **II.** Hoppers  
     **III.** LAB IDX Coin Xeptor
- M Sep 15:    **Quiz 3/4** (Microprocessors, memory, and microcontrollers ,Coin-in assembly, and Hoppers)  
**Peripherals** **6.1.1.1**  
     **I.** Switches  
     **II. LAB:**  
         Interfacing switches to a micro controller and using it to drive various displays. This is a three part Lab. Steps 1 – 3 are on 15 Sep. Steps 4 and 5 will be accomplished on 24 Sept, and the final extra credit part is due before the last week of class.
- W Sep 17:    ~~Quiz 5 (switches and microcontroller inputs/displays)~~  
**Peripherals** **6.2.1.1**  
     **I.** Review before class the Dollar Bill Validator (DBV) schematic and Learning Module referenced article on operation
- M Sep 22:    **Peripherals** **6.3.1.1**  
     **I.** JCM Calibration LAB on their UBA DBV
- W Sep 24:    **Quiz 5** (Bill Validator)  
**Peripherals** **6.4.1.1**  
     **I.** CRT monitor  
     **II.** LCD monitor  
     **III.** Touch screen  
     **VI.** Part 2 of the Lab on Switches and Displays
- M Sep 29:    **Peripherals**   **Quiz 6/7** (CRT, LCD, Touch screen)  
     **I.** Finish the revised last part of the Lab on Switches and Displays and Touch Screen demo  
     **II.** Sound

- III. Reel stepper motors
- VI. Reels assemblies
- ~~V. Physical reel strips (SS 3668)~~

W Oct 1: **Quiz 7** (Switches and microcontroller inputs/displays, and CRT, LCD, Touch screens)

**Peripherals**

- I. Items not completed on 29 Sep, 2008
- II. LAB 4

M Oct 6: **Quiz 7** (Stepper reels)

- I. Meters,  
Hard meters, Soft meters, ~~PSRs~~
- II. **Midterm review**

W Oct 8: I. PSRs, and Physical reel strips (SS 3668)

- II. LAB 5
- III. Midterm review

M Oct 13: **Midterm exam**

W Oct 15: **Introduction to Random Number Generators (RNG) 7.1.1.1**

- I. Pseudo RNG (PRNG) theory
- II. Linear Congruential Generator (LCG)

M Oct 20: **Introduction to Random Number Generators (continued)**

- I. LCG continued
- II. Lagged Fibonacci Generator (LFG)
- III. Shift Register PRNG
- IV. **Reel strips:** - Physical reel strips, Virtual reel strips
- V. **Schematics** (Old & New S+ and Blue Bird)

W Oct 22: I. **Schematics** (Old & New: S+ and Blue Bird) *continued*

- II. LAB 6 Take Home

M Oct 27: **Quiz 9** (PRNG, Reel strips, pay tables, and Stepper motors)

- Probabilities related to pay odds.** **7.4.1.5**
- Slot Math (Video), Reel strip analysis, Decks

W Oct 29: **Stepper Motor LAB**

M Nov 3: **I. Vision and S Plus schematics**  
(P.S., PISO, SIPO, Stepper, Watchdog, etc.)

**II. LAB 7 Take Home**

- W Nov 5:     **Maintenance and support** (Video)
- I. System Maintenance
  - II. Statistical recall, Game recall
  - III. Lab Customer Service Lab and Lab Attendant/Operator Modes
  - ~~VI. Troubleshooting methodology (Video and manual)~~
  - ~~V. Lab Troubleshooting~~

- M Nov 10:   **Maintenance and support (continued)**
- I. S Plus schematics Memory access
  - II. LAB 8 Take Home

- W Nov 12:   **I. Flash, EPROM, and RAM changing (Extraction and Insertion tools)**
- II. Detecting cheating and machine tampering
  - III. Troubleshooting methodology (Video and manual)
  - IV. Lab Troubleshooting

- M Nov 17:   **I. Quiz on Maintenance and Troubleshooting**
- II. Casino management system and player tracking system overview
  - III. Group project preparation secession

- W Nov 19:   **I. Key Chipping Lab**
- II. Slot Management System LAB

- M Nov 24:   **Local area network (LAN). 10.1.1.1**
- I. Seven layer ISO/OSI model
  - II. Topologies and cabling
  - III. Group project preparation secession

- W Nov 26:   **Quiz 10 (LAN)**
- I. **LAB** Building common data cables (patch and crossover)
  - II. **Wide area network (WAN).** 11.1.1.1
  - III. Group project preparation secession

- M Dec 1:     **Installation and set up**
- I. Power considerations (Section 2 Machine Installation Manual)
  - II. Upright Stands Hardware and software options (PSR)
  - III Group project preparation secession

- W Dec 3:    **I. Slot Cheats**
- II. Group project preparation secession

Mon May 7: **Final review and Students Presentation of design**

Wed May 9: **Final exam**

## **SLOT MACHINE SPECIAL DESIGN PROJECT**

1. Design a three reel slot machine that will:
  - A. Have a free running PRNG that will generate 63 or 64 random numbers.
  - B. Start the reels to spin when the PLAY (SPIN) button is depressed.
  - C. Reel 1 is to spin for at least three revolutions before stopping. Reel 2 is to spin for at least five revolutions before stopping. Reel 3 is to spin for at least seven revolutions before stopping.
  - D. The reels will stop on a position selected by YOU (via your PRNG).
  - E. Random numbers picked for *each* reel will be at random.
  - F. Two seven segment displays will display the random numbers picked for each reel.
2. Basic Stamp microcontrollers and/or TTL/CMOS/MSI logic will be used. Circuits in S-PLUS manual (schematic) may be duplicated.
3. At least 2 students will work as a design team.
4. The design will be documented. Documentation will include:
  - A. A block diagram of the design
  - B. A block diagram or algorithm of the PRNG.
  - C. A “virtual” reel with 63 stops utilizing the “RED-WHITE-BLUE” SEVENS reel strips displayed on the wall.
  - D. A complete parts list.
5. Presentations will meet the following criteria:
  - A. Power point slides
  - B. Will review the design documentation
  - C. Discuss the design considerations and trade-offs that resulted in your design.
6. Paper design (above) in Slot Machine Principles I. Design implementation in Slot Machine Principles II.