

**PALOMAR COLLEGE**  
**COURSE OUTLINE OF RECORD FOR**  
**DEGREE CREDIT COURSE**

Transfer Course    A.A. Degree applicable course  
(check all that apply)

**COURSE NUMBER AND TITLE:** ECHT 102   Integrated Electronic Circuits

**UNIT VALUE:** 4.5

**MINIMUM NUMBER OF SEMESTER HOURS:** 96

**BASIC SKILLS REQUIREMENTS:** Appropriate language and computational skills.

**ENTRANCE REQUIREMENTS**

**PREREQUISITE:** ECHT 101

**COREQUISITE:** None

**RECOMMENDED PREPARATION:** None

**SCOPE OF COURSE:**

Fundamentals of linear and non-linear, analog, integrated circuits: thyristors, frequency effects, operational amplifiers, feedback, non-linear OPAMPS, oscillators, power supplies, and communication circuits. Laboratory covers application of theory, use of test equipment, circuit design, construction techniques, and troubleshooting.

**SPECIFIC COURSE OBJECTIVES:**

Successful students will be able to:

1. Demonstrate basic safety procedures designed to protect the technician, circuit components, and test equipment.
2. Compare and contrast the different types of thyristors and how they function in an electronic circuit.
3. Analyze the different frequency effects on amplifier circuits.
4. Explain how the most integrated circuit devices are constructed and operate.
5. Manipulate integrated circuits properly without exceeding their maximum ratings or damaging them with improper handling procedures.
6. Identify the most commonly used integrated circuit packages and schematic symbols.
7. Test various integrated circuit devices and circuits to determine if they are functioning properly.
8. Explain the operation of differential amplifiers, comparators, and active filter circuits.
9. Analyze and design simple inverting and noninverting amplifiers that use operational amplifiers.

10. Identify and explain the operation of power supply rectifiers, filters, and regulation circuits.
11. Explain the basic principles of oscillation, and identify and describe the operation of commonly used LC, RC and crystal oscillators.
12. Construct basic electronic circuits like amplifiers using resistors, capacitors, inductors, transformers, diodes, transistors, integrated circuits power supplies, and generators following traditional lab station procedures using standard equipment, as well as through computer simulated construction, design, and analysis.
13. Apply developed troubleshooting techniques to solve electronic circuit problems utilizing electronic test equipment and computer simulated programs.
14. Utilize Excel to handle lab data and plot graphs.
15. Demonstrate basic soldering techniques in the construction of an electronic project.

## **CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:**

### **I. Thyristors**

- A. The four-layer diode
- B. This Silicon Controlled Rectifier
- C. Bi-directional Thyristors

### **II. Thyristors**

- A. Lag Circuits
- B. Lead Circuits
- C. Miller's Theorem
- D. Total Frequency
- E. Decibels

### **III. Operational Amplifiers**

- A. The Differential Amplifier
- B. Operational Amplifiers
- C. Setting Op-Amp Gain
- D. Op-Amp Applications

### **IV. Amplifier Troubleshooting**

- A. Preliminary Checks
- B. No Output
- C. Reduced Output
- D. Distortion and Noise
- E. Intermittents

### **V. Oscillators**

- A. Oscillator Characteristics
- B. RC Circuits
- C. LC Circuits
- D. Crystal Circuits
- E. Relaxation Oscillators
- F. Undesired Oscillations
- G. Oscillator Troubleshooting

### **VI. Linear Integrated Circuits**

- A. Introduction
- B. Fabrication

- C. Applications
- D. Troubleshooting
- E. Future Trends

VII. Nonlinear Op-Amp Circuits

- A. Active Diode Circuits
- B. Comparators
- C. The Schmitt Trigger
- D. The Integrator
- E. Waveform Conversion and Generation

VIII. Regulated Power Supplies

- A. Open-Loop Voltage Regulation
- B. Closed-Loop Voltage Regulation
- C. Switch-Mode Regulators
- D. Troubleshooting Regulated Power Supplies

IX. Communication Circuits

- A. Class C Operation
- B. Frequency Multipliers
- C. Harmonics
- D. Modulation

**REQUIRED READING:**

Malvino, Albert P. Electronic Principles. 6<sup>th</sup> ed. Westville, OH: McGraw Hill Book Company, 1999.

Malvino, Albert P. Experiments for Electronic Principles. 6<sup>th</sup> ed. Westville, OH: McGraw Hill Book Company, 1999

**SUGGESTED READING:**

Berlin, Howard M. Experiments in Electronic Devices. 3<sup>rd</sup> ed. Columbus, OH: Merrill Publishing Company, 1992.

Berlin, Howard M. The Illustrated Electronic Dictionary. Columbus, OH: Merrill Publishing Company, 1992.

Floyd, Thomas L. Electronics Fundamentals; Circuit Devices, and Applications. 5<sup>th</sup> Columbus, OH: Merrill Publishing Company, 2001.

Floyd, Thomas L. Electronic Devices. 5<sup>th</sup> ed. Columbus, OH: Merrill Publishing Company, 2001.

Selected handouts from the instructor and electronic/computer magazines as assigned by instructor.

**REQUIRED WRITING:**

1. Approximately 12 problem solving exercises of approximately one to three paragraphs in length used in evaluation testing.

2. Approximately 16 laboratory reports (writings related to conclusions/discussions of results of experimental findings) of approximately one to three paragraphs in length.
3. Formal project report of approximately 10-15 pages in length.

### **OUTSIDE ASSIGNMENTS:**

**Students are expected to spend a minimum of three hours per unit per week in class and on outside assignments, prorated for short-term classes.**

Reading assignments are from the text, laboratory manuals, and handouts in preparation for tests and quizzes. Approximately 300 pages in the textbook and 200 pages in the laboratory manual are required readings for the course. Writings pertain to the discussion of lab experiment results and the power supply project report of 10-15 pages.

### **INSTRUCTIONAL METHODOLOGY:**

**Check all that apply:**

- lecture  
 laboratory  
 lecture-laboratory combination  
 directed study

### **DISTANCE LEARNING:**

**This course may be offered as a distance learning course and meets Title 5 regulations 55370, 55372, 55374, 55376, 55378, and 55380.**

Yes  No

**If yes, check all that apply:**

- Television Course (Video one-way, e.g. ITV, video cassette, etc.)  
 Online Course (Text one-way, e.g. newspaper, correspondence, electronic file, etc.)  
 Two-Way Video Conferencing (Two-way interactive video and audio)  
 One-Way Video Conferencing (One-way interactive video and two-way interactive audio)  
 Computer Assisted Instruction (A specialized form of mediated instruction relying primarily on student access to information and prepared lessons or teaching materials through a computer terminal, but not under immediate supervision of a qualified instructor.)

**GRADING POLICY AND STANDARDS** (include methods of determining whether the stated objectives have been met by students):

Quizzes	5%
Homework	23%
Class Tests	31%

Average of Laboratory Experiments	25%
Power Supply Project & Report	12%
Computer Circuit Simulation	4%

**IS COURSE REPEATABLE FOR REASON(S) OTHER THAN DEFICIENT GRADE?**

Yes \_\_\_\_ No X Number of times course may be taken for credit: one

If yes, identify specific provision of Title 5 Division 2 section(s), 55761-55763 and 58161 which qualifies course as repeatable:

**CONTACT PERSON:** George Hershman x2563

<b>SIGNATURES ON FILE</b>
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