



# **ELECTRONICS Program Review 2007-2008**

*Spring 2008*

Prepared By:

Bruce Stoner, Faculty  
Lillian LaSpina and Chris Pagano, Administrative Secretaries  
Eric Rabitoy, Dean of Science, Electronics, and Health Sciences

## **ELECTRONICS PROGRAM REVIEW COMMITTEE MEMBERS 2007-2008**

Bruce Stoner, Full-Time Faculty  
Richard J. Fernandes, Full-Time Faculty  
David Endo, Adjunct Faculty  
Leigh Buchwald, Faculty  
Eric Rabitoy, Dean of Science, Electronics, and Health Sciences  
Lillian LaSpina Administrative Secretary  
Chris Pagano, Administrative Secretary  
Jeremy Clark, Academic Senate Representative  
Dave Kary, Curriculum Representative  
Irene Malmgren, Vice President of Instruction  
Michelle Plug, Articulation Officer  
Lucinda Over, Dean of Counseling  
John Thompson, Dean of Library and Information Services  
Linda Welz, Chief Information Services Officer

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## **Electronics Faculty**

### **FULL-TIME FACULTY:**

Bruce Stoner

### **ADJUNCT FACULTY:**

David Endo

Leigh Buchwald

Tim Thelander

## **Electronics Advisory Committee**

Ryan Vienna	LA Sheriff's Department – Correctional Innovative Technology Unit
Vincent Rhodes	Applied Engineering Concepts
Wayne Tolosa	Future Concepts
John Villarreal	Xerox
Manuel Martinez	Xerox
Bey Orlando	KABC-TV
Daryl Moose	Autronics Corp.
Mark Pane	MSI Consultant
Ryan J. Wright	HCI inc.
Eric Cassell	JPL
David Endo	Citrus College
Leigh Buchwald	Citrus College
Bruce Stoner	Citrus College

## **Degree and List of Certificates Offered**

In addition to an Associate in Science degree in Electronics, the following certificate is available:

### **Electronics Technician**

Required Courses: ELEC 101, ELEC 102, ELEC 201, ELEC 202, ENGR 104, and ENGR 107

The Associate in Science degree is granted to students who have completed the necessary requirements with at least 18 units in the program of study.

### **Electronics Courses**

ELEC 100	Introduction to Technology	4
ELEC 101	Electronics Fundamentals	4
ELEC 102	Electronics Communication	4
ELEC 120	Introduction to Computers	4
ELEC 201	Digital Electronics	4



## **C.S.U. Transferable Electronics Courses**

ELEC 100

ELEC 101

ELEC 102

## **Courses not offered in the last 2 years\***

ELEC 105	Introduction to PC Hardware and Configuration	4
ELEC 106	Software Installation on Personal Computers	4
ELEC 111	111 Introduction to Electronics Technology	3
ELEC 112	D.C. Circuit Networks	4
ELEC 113	A.C. Circuit Networks	4
ELEC 116	Digital Computers-Logic Design and Circuits	4
ELEC 117	Digital Computers-Systems	4
ELEC 130	Computer Assisted Schematic, PCB Design, and Assembly	3
ELEC 185	185 Introduction to Microprocessor Based Systems	4
ELEC 214	Op-Amp and Transistor Circuit Analysis	4
ELEC 224L	Op-Amp and Transistor Circuit Analysis Lab	1

\*The Electronics Department eliminated these courses from the program in April, 2008.

The Electronics Program has adopted the Institutional General Education Competencies of Citrus College. The General Education Competencies (as set forth in the Academic Senate minutes dated August 25th 2004) are as follows:

## **Institutional General Education Competencies- Part of Institutional Mission**

General education competencies serve as a common set of core curricular components identified and defined by faculty. Student learning outcomes are behaviors based on these competencies.

Any student transferring, completing a degree or certificates from Citrus College, must demonstrate effectively assessed awareness, understanding, knowledge, skills, and abilities in the selected competencies.

1. Communication (personal expression and information acquisition)

Examples

Reading analytically and critically  
Writing with clarity and fluency

Speaking articulately  
Listening actively

2. Computation

Examples

Technology  
Math proficiency  
Analyzing and using numerical data  
Application of mathematical concepts and reasoning

Computer proficiency  
Decision analysis  
(Synthesis and evaluation)

3. Creative, Critical, and Analytical Thinking

Examples

Curiosity  
Analysis  
Synthesis  
Evaluation  
Creativity

Research  
Learning Strategies  
Problem Solving  
Decision making  
Aesthetic awareness

4. Community, Critical, and Analytical Thinking

Examples

Respect for others beings  
Cultural awareness  
Ethics  
Community service  
Integrity

Citizenship  
Interpersonal skills  
Lifelong learning  
Self esteem  
Empathy

5. Technology/information competency

Examples

Basic computing and word processing

6. Discipline/subject Area Specific Content Material - Project Plan

## **Program Description**

The classes in the Electronics Program are designed to prepare students for transfer to four-year institutions or gain employment as technicians in electronics and related fields. Due to rapid changes in electronics technologies, the program also offers continuing opportunities to enhance and upgrade job skills. The program's articulation agreements allow students majoring in electronics to transfer into the electrical computer engineering programs in both public and private institutions. Additionally, through the Associate of Science Degree, students are prepared for transfer into selected four-year California State University's general electronic engineering, manufacturing, and related technology programs.

## **Program Student Learning Outcomes**

Electronics students will have a broad understanding of Electronics. Students will be able to design, interpret, analyze and evaluate electronic instruments appropriate for each class. Students completing courses in the Electronics Program will have acquired understanding, knowledge, skills and abilities in the following competencies:

### **Communication**

Electronics students will use proper vocabulary and notation when describing Electronics concepts. They will be able to communicate these concepts to others both verbally and in written form. They will be able to critically analyze electronics information found in print, visual or online media such as technical and non-technical books, journals, articles, web pages, television and film.

Electronics instruction involves working in teams, listening carefully to the instructor and co-workers, and clearly articulating one's own point of view. Students will listen and speak well enough to explain schedules and procedures, communicate with customers, work in teams, understand customer concerns, describe complex systems and procedures, probe for hidden meanings, teach others and solve problems.

### **Computation**

Electronics students will apply electronics concepts in mathematical form using the appropriate computational skills for the course. This may include numeric calculation using simple algebra, trigonometry of the right triangle, 2D graphical analysis, the evaluation of mathematical expressions, and schematic drawings. Students will calculate the characteristics of electronic circuits and approach practical problems by appropriately choosing from a variety of mathematical techniques. Students will understand the meaning of these calculations in order to better understand the processes that generate circuit characteristics.

### **Creative, Critical, and Analytical Thinking**

Electronics students will develop an understanding of and curiosity toward electrical circuits through problem solving, decision making and critical thinking. Students will

recognize problems and devise and implement plans of action to correct the problem. Students will organize and process symbols, pictures, graphs, objects and other information. Students will be exposed to a variety of efficient learning techniques which will allow them to apply new knowledge and skills. Students will identify rules or principles underlying the relationship between two or more circuit pairs and apply them when solving problems.

### **Technology/Information Competency**

Electronics students will be adept at procedures, hand tools or electronic equipment including computers and related technologies. They will be able to apply technology to the completion of a task. Electronics students will understand overall operation and proper procedures for setup and operation of equipment. Electronics students will maintain, prevent, identify and solve problems with equipment, including computers and other technologies.

### **Community, Global Consciousness**

Electronics students will think logically and coherently about technical issues and gain an appreciation for the global, social and political impact of technical endeavors. By working together in lab and/or on projects, students develop interpersonal skills and respect for others. Through team learning, they will acquire an understanding for the need of lifelong learning. Students will understand the ways in which electronics and computer processes lead to the improvement of quality of life. Students will obtain an appreciation of the global environmental effects associated with the production and recycling of electronic devices.

## **Program Goals**

The goals of the program are:

1. Provide electronics education courses for transfer credit to four-year colleges and universities.
2. Meet the student learning outcomes and core competencies institutionalized by Citrus College.
3. Provide basic electronics knowledge and skills for students.
4. Provide electronics courses required for students to complete an Associates degree or earn an Electronics certificate.
5. Prepare basic electronics knowledge and skills for industry certification.
6. Provides lifelong learning opportunities for currently employed persons.



## SLO Timeline

The Electronics faculty will develop student learning outcomes for all Electronics classes offered at Citrus College based on the following schedule:

### Course Title   Projected date to develop course outline

ELEC 100	Introduction to Technology	Completed
ELEC 101	Electronics Fundamentals	December 2008
ELEC 102	Electronics Communication	June 2008
ELEC 120	Introduction to Computer Technology	December 2008
ELEC 201	Digital Electronics	December 2008
ELEC 202	Solid State Devices	June 2008

Any new classes developed will have student learning outcomes developed when the curriculum is submitted to the curriculum committee.

The department will work with the curriculum committee to ensure the course outlines are being developed according to standards developed by the committee.

## Mission

### COMMENDATIONS

1. The Electronics Program conforms to the District's mission statement to provide transfer level courses. Electronics courses deliver instruction allowing students to contribute to the economic growth of today's society.
2. The Electronics Program provides occupational education for students preparing for employment.
3. The Electronics Program stresses problem solving, teamwork, communication skills, computation, use of technology and critical/analytical thinking as part of each course.
4. Student population in Electronics courses reflects the District's diversity (see course indicator demographics).

### PREVIOUS RECOMMENDATIONS COMPLETED

1. Develop specialized training and instruction programs to meet newly emerging electronics business and industry needs.
2. Two Electronics classes (Electronics 104 and Electronics 105) on computer repair and maintenance were merged into a new Engineering course (Engineering 104). Two new Information Technology courses were recently added to help students meet business and industry needs.
3. The department should continue to update certificates to meet industry's rapidly changing needs.

*Two new Information Technology courses (Engineering 104 and Engineering 107) were added into the Electronics Technician certificate. Engineering 104 provides students an understanding of computer design and repair. Engineering 107 provides students an opportunity to learn how computers interact within a network.*

4. Rename and restructure existing curriculum to meet the needs of the Information Technology industry.

*The two new Information Technology courses (Engineering 104 and Engineering 107) have been added to the electronics curriculum. Engineering 104 was added in order to help train students to work in industry who can build and repair computers. Engineering 107 was added to ensure that the student can connect computers into an existing network and/or design a network.*

## **RECOMMENDATIONS**

1. Faculty members in the department need to identify equipment, software and tools that must be updated or acquired on an annual basis in order to provide students with the latest technology.
2. Continue to list the Electronics Program Certificates in the College Catalog and update to keep current.
3. Utilize marketing and recruitment techniques to attract students in our district and to ensure that the District's diversity continues to be represented in the Electronics Program.
4. Review and evaluate requirements for the Electronics major for the Associate of Science degree (AS).
5. Faculty should complete writing and begin assessment of student learning outcomes for all electronics courses.

## **Need**

### **COMMENDATIONS**

1. The Electronics Program meets the growing need for trained personnel in this field as identified by the advisory committee.
2. The Electronics Program meets the needs of the electronics communication field for persons with the FCC (Federal Communications Commission) license.
3. Faculty members have developed a course (Electronics 100) as part of the Recording Arts Program. This course is now identified as a prerequisite to the Recording Arts Program.
4. Faculty members have developed a course (Electronics 120) as a recommended prerequisite to the Recording Arts Program.
5. Faculty members should actively participate with our outreach program for advertisement and recruitment of potential students.

## **PREVIOUS RECOMMENDATIONS COMPLETED**

1. The program needs increased representation from the telecommunications industry on the Advisory Committee.

*Faculty members have recruited members from the cell phone and network communications industries.*

2. The program needs to continue developing industry certification in the computer networking and engineering areas.

*Faculty members have developed courses in computers and networking in conjunction with faculty in the Department of Engineering.*

3. Classes that have not been offered for several semesters should be discontinued.

*Classes that have not been offered for the last two years are being removed from the catalog and certificates. These classes include ELEC 105, 106, 111, 112, 113, 116, 117, 130, 185, 214 and 224L.*

4. Curriculum needs to be continuously updated to reflect student and industry needs.

*Course syllabi are updated to reflect recent changes in industry standards.*

## **RECOMMENDATIONS**

1. Faculty should continue to offer and design curriculum aimed at providing students with the knowledge and tools necessary to successfully pass industry exams.
2. Faculty should continue to ensure that students understand the principles of basic electronics and can adequately perform industry job expectations.
3. Faculty should continue to evaluate and revise class curriculum in order to adequately prepare students for employment, transfer and the FCC license.
4. Faculty should actively participate in career days for local high schools.
5. Revise Electronics classes to facilitate expansion of the program and meet the demands of the workplace.
6. Initiate new contacts with the local business community and the advisory committee to provide input that will enhance the program.
7. Electronics faculty should keep current with the needs of other programs to evaluate the impact and significance of electronics courses.

## **Quality**

### **COMMENDATIONS**

1. Faculty members are well qualified with many years of experience.
2. Faculty members actively utilize technology with computer animation and circuit simulation in classroom presentations.
3. Courses are designed to provide the student with the standard skills required of an entry-level electronics technician as identified by the Electronics Industries Association and the Electronics Industries Foundation.
4. Courses are designed to provide the standard skills required for articulation between member colleges of the International Electronics Technician Articulation Committee and four-year colleges and universities.
5. Course numbering follows a logical, sequential pattern.

6. Curriculum in the Electronics Program reflects that of transfer institutions.
7. All Electronics course syllabi meet guidelines set forth by the Academic Senate.
8. Faculty members continue to be leaders in incorporating technology into their instructional program.

### **PREVIOUS RECOMMENDATIONS COMPLETED**

1. Faculty needs to identify equipment, software, and tools that need to be updated or acquired on an annual basis so to include latest technology.  
*Equipment to replace and update outdated devices were purchased and integrated into the Electronics Program. New software was purchased to produce videos for distance learning for the Navy NCPACE Program.*
2. The advisory committee has suggested distance-learning courses be developed for persons working in the industry that have practical knowledge but would like verification in the form of certification or an associate of science degree.  
*Distance learning classes were considered, but issues regarding laboratory procedures in a DE environment prevented implementation of a full distance-education course offering. A pilot program using videos for a demonstration laboratory format was used in the Navy NCPACE Program.*
3. Incorporate new technological developments into curriculum.  
*New technological developments are constantly introduced from newspaper articles, industry periodicals and news web sites.*

### **RECOMMENDATIONS**

1. Electronics course descriptions should be reviewed and updated as needed.
2. Faculty members should develop and integrate student learning outcomes into each course outline of record.
3. Electronics course content should provide the student with standard skills required of an entry-level electronics technician as identified by the Electronics Industries Association and the Electronics Industries Foundation.
4. All class syllabi should include student learning outcomes, clear grading standards, attendance and test make-up policy, drop date, office hours, homework policy and general DSPS and FERPA statements.
5. Electronics faculty should expand representation on the advisory council. The advisory council should include present and past students, community members and industry employers.
6. Electronics faculty should update current degree requirements.

### **Feasibility**

#### **COMMENDATIONS**

1. Software and equipment in the laboratory is constantly upgraded to meet industry standards.

2. Through the use of VTEA funding, PC 316 was remodeled to meet the needs of the networking courses (ELEC 107, 108 and 109).

### **PREVIOUS RECOMMENDATIONS COMPLETED**

1. Equipment and software needs to be continually updated to include latest technology.

*New hand-held digital oscilloscopes and hand-held digital multimeters were purchased and integrated into the program.*

2. The program needs to continue following the plan for developing industrial certification in many areas. The requirements for the FCC and CompTIA's, A+ and Net+ certification should be the first completed.

*CompTIA's, A+ and Net+ were the first industrial certifications completed.*

*Students can now receive training and take these certification exams as part of the new Electronics/Engineering Program course offerings of ENGR 104 and ENGR 107. The requirements for the FCC licensing for radio and radar technicians are covered in the electronics core program courses.*

### **RECOMMENDATIONS**

1. Equipment and software needs to be continually updated to include latest technology.
2. The Electronics Program needs to evaluate the development of new industrial certifications. The requirements for the FCC and CompTIA's, A+ and Net+ certification must be included in course curriculum.

## **Compliance**

### **COMMENDATIONS**

1. The Electronics Program transfers to both the California State University and private university systems.
2. Electronics course requisites meet federal, state and district requirements.
3. Existing Electronics course outlines are being updated to reflect new requirements.
4. The Electronics Program hosts regular meetings with the Electronics Advisory Council.

### **RECOMMENDATIONS**

1. Faculty in Electronics review syllabi, course outlines, course prerequisites, and the long-range plan in respect to state and district requirements.
2. Continue course review of the Electronics Program by faculty and the Advisory Committee to ensure relevancy to the needs of the business world and articulation with private universities and the California State University system.

<b>Key Program Performance Indicator</b>	<b><u>01-02</u> Year 1</b>	<b><u>02-03</u> Year 2</b>	<b><u>03-04</u> Year 3</b>	<b><u>04-05</u> Year 4</b>	<b><u>05-06</u> Year 5</b>	<b><u>06-07</u> Year 6</b>
<b><i>Program Access</i></b>						
Majors	N/A	N/A	N/A	N/A	N/A	N/A
New Majors	N/A	N/A	N/A	N/A	N/A	N/A
Courses Offered						
Day	12	12	12	14	14	14
Evening	13	9	2	2	2	2
Weekend	0	0	0	0	0	0
Short Term	0	0	0	0	0	0
Distance Education	0	0	0	0	0	0
Classes Offered (# of sections)						
Day	12	12	12	14	14	14
Evening	13	9	2	2	2	2
Weekend	0	0	0	0	0	0
Short Term	0	0	0	0	0	0
Distance Education	0	0	0	0	0	0
Registrations						
Weekly Student Contact Hours	1,550	1,267	1,053	1,120	1,179	1,138
Full-Time Equivalent Students	51.67	42.23	35.10	37.33	39.30	37.93
Non-Traditional/Special Populations						
Available Jobs	Annual Average Employment 2004-2014 is estimated to grow from 4,270 to 4,550 (6.6%) for Electrical and Electronic Engineering Technician in L.A. County ( <a href="http://www.labormarketinfo.edd.ca.gov">www.labormarketinfo.edd.ca.gov</a> )					
<b><i>Program Resources</i></b>						
Full-Time Equivalent Faculty	3.60	3.85	2.80	2.80	2.80	2.80
Credit Reimbursement Rate	2,794.76	2,850.73	2,790.53	2,922.30	3,259.71	3,476.34
Revenue-FTES x Reimbursement Rate	144,405.25	120,386.33	97,947.60	109,089.46	128,106.60	131,857.58
Total District Program Budget	115,343.00	96,325.00	83,774.00	97,650.00	96,553.00	107,853.00
Personnel	54,543.00	81,319.00	74,435.00	84,566.00	98,248.00	
Grants	0	0	0	0	0	0

<b>Key Program Performance Indicator</b>	<b><u>01-02</u> Year 1</b>	<b><u>02-03</u> Year 2</b>	<b><u>03-04</u> Year 3</b>	<b><u>04-05</u> Year 4</b>	<b><u>05-06</u> Year 5</b>	<b><u>06-07</u> Year 6</b>
Supplies	2,760.00	14.00	2,312.00	2,453.00	4,264.00	775
Industry Contributions						
VTEA	0	0	0	0	0	0
<b><i>Program Efficiency</i></b>						
Productivity – WSCH/FTEF (525=good)	430	329	376	400	421	406
Average Class Size	24.5	24.6	26.0	26.8	30.4	24.63
Fill Rate at Census	74%	77.0%	74.0%	70%	74%	64%
FTES per FTEF	14.35	10.96	12.53	13.33	14.03	13.54
Cost per FTES	1,145.05	1,925.95	2,186.52	2,331.07	2,608.45	
Cost per Major	N/A	N/A	N/A	N/A	N/A	N/A
<b><i>Program Success</i></b>						
Course Retention (D or better)	77.5%	80.5%	70.0%	65.1%	69.8%	68.4%
Course Success – Any Course (C or better)	74.1%	75.8%	68.8%	58.1%	65.3%	63.1%
Course Success – Next Course (C or better)						
Course Success – Advanced Course (C or better)						
Major Persistence						
Degrees Awarded	N/A	N/A	N/A	N/A	N/A	N/A
Certificates Awarded	0	4	0	1	11	3
Skills Awards	None offered					
Licenses	None offered					
Transfers						
Performance Following Transfer						
Student Satisfaction*						
Employment Rate*						
Employment Retention*						
Employer Satisfaction*						15

<b>Key Performance Indicator</b>		<b><u>01-02</u> Year 1</b>	<b><u>02-03</u> Year 2</b>	<b><u>03-04</u> Year 3</b>	<b><u>04-05</u> Year 4</b>	<b><u>05-06</u> Year 5</b>	<b><u>06-07</u> Year 6</b>
<b>Student Demographic Data</b>							
Gender	Female	27 (12%)	24 (12%)	12 (8%)	18 (9%)	14 (7%)	12 (7%)
Gender	Male	192 (88%)	181 (88%)	148 (93%)	174 (91%)	174 (93%)	170 (93%)
Age	< 17	0	1 (0%)	0	1 (1%)	0	0
Age	17 - 19	78 (36%)	70 (34%)	68 (43%)	78 (41%)	78 (41%)	88 (48%)
Age	20 - 24	86 (39%)	73 (36%)	66 (41%)	69 (36%)	79 (42%)	63 (35%)
Age	25 - 29	28 (13%)	24 (12%)	19 (12%)	25 (13%)	15 (8%)	12 (7%)
Age	30 - 39	14 (6%)	27 (13%)	7 (4%)	11 (6%)	9 (5%)	12 (7%)
Age	40 - 49	11 (5%)	5 (2%)	0	7 (4%)	5 (3%)	4 (2%)
Age	50 - 59	2 (1%)	2 (1%)	0	0	2 (1%)	3 (2%)
Age	60 - 69	0	4 (2%)	0	1 (1%)	0	0
Ethnicity	Hispanic	81 (37%)	59 (29%)	53 (33%)	76 (40%)	74 (39%)	79 (43%)
Ethnicity	Caucasian	64 (29%)	66 (32%)	55 (34%)	65 (34%)	61 (32%)	50 (27%)
Ethnicity	Black	14 (6%)	17 (8%)	8 (5%)	13 (7%)	15 (8%)	9 (5%)
Ethnicity	Asian	22 (10%)	28 (14%)	26 (16%)	20 (10%)	14 (7%)	24 (13%)
Ethnicity	Filipino	9 (4%)	10 (5%)	7 (4%)	4 (2%)	3 (2%) <sup>1</sup>	4 (2%)
Ethnicity	Native American	3 (1%)	4 (2%)	1 (1%)	4 (2%)	3 (2%)	0
Ethnicity	Pacific Islander	3 (1%)	6 (3%)	1 (1%)	1 (1%)	1 (1%)	3 (2%)
Ethnicity	Other Non White	7 (3%)	3 (1%)	4 (3%)	3 (2%)	6 (3%)	1 (1%)
Ethnicity	Unknown	16 (7%)	13 (6%)	5 (3%)	6 (3%)	11 (6%)	12 (7%)
ED Goal	AA or AS Degree	29 (13%)	24 (12%)	20 (13%)	25 (13%)	25 (13%)	33 (18%)
ED Goal	Degree & Transfer	65 (30%)	64 (31%)	58 (36%)	70 (36%)	60 (32%)	54 (30%)
ED Goal	Transfer No Deg	24 (11%)	24 (12%)	28 (18%)	30 (16%)	29 (15%)	28 (15%)
ED Goal	Certificate	57 (26%)	47 (23%)	30 (19%)	51 (27%)	49 (26%)	45 (25%)
ED Goal	Job Skills	22 (10%)	19 (9%)	10 (6%)	6 (3%)	6 (3%)	4 (2%)
ED Goal	Personal	17 (8%)	23 (11%)	12 (8%)	6 (3%)	13 (7%)	12 (7%)
ED Goal	Unknown	5 (2%)	5 (2%)	2 (1%)	4 (2%)	6 (3%)	6 (3%)