San Bernardino Valley College
Curriculum Approved: November 8, 2004

I. COURSE INFORMATION:

A. Division: Technical
Department: Electricity/Electronics
Course ID: ELECTR 290B
Course Title: Industrial Computers and Robotics Maintenance
Units: 4
Lecture: 3 hours
Laboratory: 3 hours
Prerequisite: ELECTR 266
Corequisite: None
Dept. Advisory: None

B. Catalog and Schedule Description: A comprehensive study of computers and robots used in industry. Including diagnostics and programming for controlling robots, machines and medical equipment.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES:

Upon successful completion of the course, the student should be able to:

A. Discuss the mechanical considerations and drive methods for robotics.
B. Distinguish between different sensors used in robotic applications.
C. Classify robots by control methods.
D. Organize computer hardware and software for robot systems.
E. Describe robot vision.
F. Compare different robot applications.

IV. COURSE CONTENT:

A. Introduction
   1. Robot terminology
   2. Basic components
   3. Robot motion
   4. Robot technology levels
B. Basic Features of the Manipulator
   1. Manipulator arm geometry
C. Major Internal Components of Controllers
   1. General features of controllers
   2. Characteristics of controllers
   3. Input power supply board
   4. Master control board
   5. Memory boards
   6. Servo control board
D. Basic Robotic Programming
   1. Features of the user's program
   2. Developing the program
   3. Flowcharting the program
   4. Machine coding the program
E. Operational Aids
   1. Teach pendant
   2. Operator's panel
   3. Manual data input panel
   4. Computer control test
F. Hydraulic and Pneumatic Drive Systems
   1. Principles of hydraulics
   2. Hydraulic system symbols
   3. Hydraulic actuators

4. Directional controls
5. Hydraulic pumps
6. Pneumatic systems

G. DC and AC Motor Operation
1. DC motors
2. Speed control for DC motors
3. Stepper motors
4. AC induction motors

H. Servo System Control
1. Closed-loop servo system
2. Feedback components
3. Servo amplifiers
4. Programmed servo signals

I. Robot Gears and Linkages
1. Basic concept of mechanics
2. Gears
3. Belts
4. Chains

J. Interfacing
1. Interfacing for the controller
2. Program control of interfacing
3. Connections for interfacing

K. Robotic Sensors
1. Types of sensors
2. Advanced tactile sensors
3. Sensor programming

L. Robotic Applications
1. Machine loading and unloading
2. Die casting
3. Welding
4. Painting

M. Summary

V. METHODS OF INSTRUCTION: (Please check all that apply and add any additional not listed.)

X Lecture
X Class and/or small group discussion
_____ Critical evaluation of texts, newspapers, journal articles, and other printed research
_____ Critical evaluation of films, videotapes, audiotapes, or other media forms
X Classroom demonstrations
_____ Field trips
_____ Guest speakers
X Other: Practical lab experiments with robot trainers
_____ Other:
_____ Other:

VI. TYPICAL OUT-OF-CLASS ASSIGNMENTS:

A. Reading Assignment. Reading assignments are required and may include (but are not limited to) the following: After reading the chapter on Hydraulic and Pneumatic Drive Systems, discuss in small groups the pneumatic systems.

B. Writing Assignment. Writing assignments are required and may include (but are not limited to) the following: Written homework assigned each week from the questions and problems in each chapter

Typical Questions:

1. How can the manipulator be made portable? Draw a sketch to support your answer.
2. A manipulator produces 2250 foot-pounds of work over a distance of 22.5 feet. What is the force required to develop this work?

C. Critical Thinking Assignment. Critical thinking assignments are required and may include (but are not limited to) the following: Practical labs with written conclusions

1. Develop a flow diagram to make the robot pick up an object in one place and put it down at a different level in a different place.
2. Machine code your program.
3. Apply your program to the robot.

VII. EVALUATION:

A student's grade will be based on multiple measures of performance and will reflect the objectives explained above. A final grade of "C" or better should indicate that the student has the ability to successfully apply the principles and techniques taught in this course. These evaluation methods may include, but are not limited to, the following (Please check all that apply, and add additional ones not listed):

_____ Portfolios
X Projects
_____ Written papers or reports
_____ Presentations (oral and visual)
_____ Work performance (internships or field work)
X Lab work
X Comprehensive examinations (cumulative finals or certifications)
_____ Peer evaluation
_____ Self evaluation
_____ Classroom participation
_____ Homework
_____ Other:
_____ Other:
_____ Other:

VIII. TYPICAL TEXTS:

A. Giulliani, Peter, Electrical Control for Machines, 6th Edition, Delmar, New York, 2004
B. Kilian, C., Modern Control Technology, Delmar, New York, 2001

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

Scientific calculator

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PREREQUISITE/COREQUISITE/ADVISORY
COURSE GRID FORM

Target Course: ELECTR 290B Industrial Computers and Robotics Maintenance

Prerequisite Course: ELECTR 266 Microprocessor Technology

Instructions:
1) List exit competencies (skills) from Prerequisite Course. These skills are listed in the "Student Outcomes" section of the Course Outline ("upon completion of the course, the student should be able to…")
2) Indicate which of the listed exit competencies (skills) are necessary entry skills needed for success in the target course. Mark with an "X" each needed skill.
3) Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:

1=Critical 2=Very Helpful 3=Desirable

Skills Analysis

Entry Skills in Target Course	Exit Skills Provided by Prerequisite Course (Mark with an X if needed and indicate Prerequisite Course if more than one).	Degree of Importance (Rate 1 – 3)
1. Respond to the terminology used in microprocessors.	X	1
2. Interpret stack functions, addressing, logic instructions and register functions.	X	1
3. Explain different support chips used for timing and memory.	X	2
4. Explain the purpose of the microprocessor as applied to computer technology.	X	1
5. Construct various microprocessor circuits and interface circuits to specifications.	X	1
6. Explain the operation of various microprocessor circuits.	X	2
7. Describe the purpose and function of peripheral devices.	X	1
8. Analyze waveforms at various points in microprocessor circuits.	X	2
9. Troubleshoot microprocessor circuits.	X	1