

PALOMAR COLLEGE
COURSE OUTLINE OF RECORD FOR
DEGREE CREDIT COURSE

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

COURSE NUMBER AND TITLE: ECHT 204 Microcomputer Architecture and Interfacing

UNIT VALUE: 4.5

MINIMUM NUMBER OF SEMESTER HOURS: 96

BASIC SKILLS REQUIREMENTS: Appropriate language and computational skills.

ENTRANCE REQUIREMENTS

PREREQUISITE: ECHT 203

COREQUISITE: None

RECOMMENDED PREPARATION: None

SCOPE OF COURSE:

Advanced computer electronic concepts and applications using digital circuits and systems. Interfacing of microprocessors and PC's (personal computers) to peripherals. Upgrading of desktop PC's. Designing, testing, and troubleshooting of computer systems and special projects. CSU

SPECIFIC COURSE OBJECTIVES:

Successful students will be able to:

1. Identify the primary components of a microprocessor.
2. Utilize Oscilloscopes, DMM., and Logic Analyzer to measure parameters of circuit operations.
3. Describe four (4) different methods by which a MPU can drive 7-segmet displays.
4. Prepare a diagram showing how mechanical switches can be connected to an MPU.
5. Explain how the MPU can eliminate the effects of contact bounce.
6. Explain the operation of a program that detects contact closure of switches, provides for debouncing, and decodes a simple keyboard.
7. Prepare a simplified block diagram of a PIA and explain the purpose of the output, control, and data direction register.

8. Prepare a simple program that will configure the PIA in any desired input-output combination.
9. Explain how the PIA can be used to drive displays and encode keyboards.
10. Interface digital and analog devices to the MPU/PIA assembly and program the system to generate D/A and A/D conversion signals (ramp, triangle, square, pulse, and sinusoidal waveforms).
11. Program the MPU/PIA interface system to generate a video signal for interfacing with a TV-RF modulator for CRT display.
12. Simulate a computer character generator function by programming the MPU/PIA and TV-RF modulator for CRT display.
13. Prepare programs for the MPU/PIA interface system to generate TTL serial data for interfacing with a Teletype machine (TTY), printer, magnetic tape (cassette), and magnetic disk (floppy disk).
14. Connect the MPU/PIA interface system to an EPROM and operational amplifier for programming of the EPROM chip.
15. Design, assemble, and test an 8-bit I/O port onto a wore-wrapped PC board. The project includes use of a 68HC11MPC, 804ADC, 808DAC, and a hexadecimal display. Students will write a program to exercise the DAC circuit (waveform generation).

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:

- I. Interfacing Fundamentals
 - A. Buses
 - B. 3-state Logic
 - C. The 6800 Interface Lines
 - D. Instruction Timing
- II. The Peripheral Interface Adapter
 - A. Input/Output (I/O) Diagram
 - B. PIA Registers
 - C. Addressing the Registers in the PIA
 - D. Programming Initialization
 - E. Addressing the PIA
- III. Using the PIA/MPU Interface
 - A. Driving 7-Segment LED Displays
 - B. Decoding Keyboards
 - C. Decoding a Switch Matrix
 - D. Program Control of I/O Operations
 - E. Polled Interrupt
 - F. Interrupt Control of I/O Operations
 - G. Co-Processors
 - H. Non-maskable Interrupts
 1. Instruction Vectored
 2. Fixed Address
 3. Fixed Vector
 4. Dynamic Vector
- IV. MPU/PIA and Digital-to-Analog (D/A) Interfacing Techniques
 - A. General D/A Concepts
 - B. Types of D/A Converters
 - C. Interfacing the D/A Converter to the MPU/PIA Assembly
 1. Waveform Generation
 - a. Ramp
 - b. Triangle
 - c. Square

- d. Pulse
 - e. Sine Wave
 - 2. Programmable Gain Amplifiers
 - 3. Motor control and positioning
- V. MPU/PIA and Analog-to-Digital (A/D) Interfacing Techniques
 - A. General A/D converter concepts
 - i. Ramp generation
 - ii. Successive approximation
 - iii. Integration
 - B. Interfacing the A/D converter to the MPU/PIA assembly
- VI. Serial Data Communications
 - A. Serial data formats and standards
 - i. ASCII coding
 - ii. Asynchronous transmission
 - 1. Half/full duplexed
 - 2. Non-hand shake
 - 3. Hand shake (DTR, CTS, DCD, RTS)
 - iii. Synchronous transmission
 - 1. SDLC
 - 2. Bi-sync
- VII. Parallel/Serial Conversion
 - A. Software conversion
 - i. Receive operations
 - ii. Transmit operation
 - B. Hardware conversion
- VIII. Peripheral Devices
 - A. Serial standard conversion
 - i. TTL/RS232C interface
 - ii. TTL/(20mA current loop) interface
 - iii. RS232C/(20mA current loop) interface
 - iv. TTL/(Kansas City Standard) interface
 - v. Modulator/Demodulators (MODEMS)
 - B. Peripheral I/O devices
 - i. The teletypewriter (TTY interfacing)
 - ii. The printer (Printer interfacing)
 - iii. The CRT data terminal
 - 1. CRT data terminal interfacing
 - 2. Intelligent terminals
 - iv. The TV receiver output (RF modulator)
 - C. IEEE-488 (HPIB)
 - D. Networks
 - i. Ring (DCS)
 - ii. ALOHA (CSMA)
 - iii. Ethernet (CSMA/CD)
 - iv. STAR (DCP)
 - v. Physical layers
 - 1. CCITT V.24
 - 2. X.25
- IX. Mass Storage Peripheral Devices
 - A. Floppy-Drives

- B. Hard-Drives
- C. CD-ROM drives
- X. Become familiar with personal computer components such as motherboard (MPCA), Hard-Drive (HDD), Floppy-Drive (FDD), CD-ROM Drive, Video Card, Display Monitor, 1284 Printer Port and RS232 port. Explain the relationship between the Windows Operating System (OS), Basic I/O System (BIOS) and Dos Software.
- X. Computer Construction Project, 8-bit I/O port
 - A. Architecture Required
 1. 68HC11MPC (Microprocessor)
 2. ADC804 (Analog-to-Decimal)
 3. DAC808 (Decimal-to-Analog)
 4. Hexadecimal Display
 - B. Wire Wrap Assembly Techniques
 - C. Testing/Troubleshooting

REQUIRED READING:

Tocci, Ronald J., Microprocessors and Microcomputers. 5th ed. Upper Saddle River, NJ: Prentice Hall, 2000.

Shan, Raj. Microprocessor Design Made Easy/Using MC68HCII. Pompano Beach, FL: Advanced Microcomputer Systems, 2000.

SUGGESTED READING:

Brown, Jerald A., and Albert P. Malvino. Digital Computer Electronics 3rd ed. Columbus, OH: Glencoe (Macmillan and McGraw-Hill) 1993.

Heath Company. Heathkit Training Manual for the Microprocessor Trainer, Model ET-3400A. Benton Harbor, MI: Heath Company, 1981.

Staugaard, JR., Andrew C. Microprocessor Interfacing. Benton Harbor, MI: Heath Company, 1982. Units 1 through 6.

Duntemann, Jeff. Assembly Language from Square One. Chicago: Scott Foresman and Company, 1990. Chapters 1 through 9.

Handouts from the instructor describing the many interface circuits and programs.

REQUIRED WRITING:

A formal laboratory report is required, reflecting industry standards for report writing and will be no less than five (5) pages in length. The discussions and conclusions of experimental results will require critical thinking.

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 text, laboratory manuals, and handouts in preparation for quizzes and examinations.

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/Tests	60%
Laboratory Reports/Project	30%
Homework	10%

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

Yes No Number of times course may be taken for credit: 1

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

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SIGNATURES ON FILE