NEW ZEALAND INSTITUTES OF TECHNOLOGY AND POLYTECHNIC QUALIFICATIONS IN INFORMATION & COMMUNICATIONS TECHNOLOGY

PRESCRIPTION: CA700 COMPUTER ARCHITECTURE & ORGANISATION

AIM OF MODULE:	To provide students with an understanding of how units within a computer work and the different methods of connecting them.
CREDITS:	7
KNOWLEDGE ASSUMED FROM:	PR630 Programming (Systems) OS610 Operating Systems (Internals) or DE600 Digital Electronics and DE610 Digital Electronics (Applied)
STUDENT LEARNING HOURS:	70
CONTENT REVISED:	Pre 1996
PRESCRIPTION EXPIRY DATE:	Nov 2011 (not currently offered by an ITP)

Level and Assessment Schedule

	Highest Skill Level				Suggested Assessment Percentage
TOPICS	R	C	A	P	
1. Introduction		*			10
2. Computer Systems Organisation		*			30
3. Micro programming		*			30
4. Conventional Machine		*			30
					100

The student will:

1 INTRODUCTION

C   Explain the general terms and concepts used in machine architecture and how all computers can be categorised in functional levels.

➢   Interpretation vs translation.

➢   Virtual machine concept.

➢   Multilevel virtual machine:

-      digital logic
-      conventional machine
-      assembly language
-      micro programming
-      operating system
-      problem oriented languages
-      hardware, software, firmware

2 COMPUTER SYSTEMS ORGANISATION

C   Explain how the individual units within a computer system work and the different ways they can be connected to form a computer system.

➢   Different ways of specifying instruction operands in terms of number and addressing method.

➢   Single processor organisation:

-      single and multiple bus structures: method and consequences
-      instruction execution: I-phase, E-phase
-      processor types: graphics, RISC technology

➢   Parallel instruction execution:

-      multiple CPUs
-      array processors
-      pipe-lining

➢   Memory organisation:

-      word lengths, different meanings and sizes
-      READ and WRITE operations on memory
-      memory management, segmentation, paging, virtual memory, cache memory, look-aside buffers - their implementations with methods and reasons

- describe the Memory organisation on a range of computers eg. - on PC, explain usual and maximum memory configurations, expanded and extended memory, EMS, plug-in boards and chips used on them.
- input/output
- data and address bus sizes
- functions necessary for I/O transfer
- select or address device
- transfer data
- synchronise transfer operation - polling and interrupts
- interfaces - serial and parallel
- DMA and character based devices
- data channels:
  - multiplexer (byte, block)
  - selector
  - block multiplexer
- describe I/O implementation on a range of computers eg. On PC, explain serial and parallel cards, disk controllers: RLL, Western Digital, SCSI, multiport terminal cards: eg. - Anvil designs for 386, micro channel
- video controllers
- distributed processing
- wide and local area networks as computer system organisation

3 MICRO PROGRAMMING

C 3.1 Describe connection of the scratch pad to ALU, shifter, MAR, MDR and the latches that select them - the data path.

C 3.2 Micro-instructions: describe function of each line to control above components.

C 3.3 Micro-architecture of chosen processor - describe the components, their connection and function.

C 3.4 Macro-architecture of chosen processor - describe the instruction set to be micro-coded.

C 3.5 Micro-program - describe the micro-code of chosen processor.

4 CONVENTIONAL MACHINE

C Describe the design constraints that manufacturers face in the design of an instruction set.

➢ Instruction length - short vs long.

➢ Memory transfer size and rates.

➢ Word length.

➢ Instruction format consideration:
  - op code length, expanding op codes, instruction formats

➢ Instruction fetch considerations - instruction length field.

➢ Operand specification - register and memory.