

4. BASIC DESIGN

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4.1 Design Policy

Although the three recipient departments of the Project have different curriculum during the two year educational program, they utilize the same laboratory. Subsequently, if the Project was geared to the needs of each department, there would be an overlapping of equipment and lab facilities; and Project content would be inflated unnecessarily, producing needless waste. In order to avoid such mishap, measures to adjust the curriculum content of each department will be taken; and effective equipment provision suitable in scope will be devised. The basic design of the Project will be based on the following policy:

- (1) Equipment will be selected on the premise that it will satisfy the needs of curriculum content while conforming to the technical and educational levels of PTC and the nation.
- (2) Equipment which will be shared by each lab will be selected to avoid straining the curriculum or affecting educational impact.
- (3) The labs and training facilities will be utilized by groups composed of a specified number of students, which will enable the course to maintain its effectiveness. The equipment will be of the quantity required for use by these group units.
- (4) The equipment will be appropriate in scope to enable it to be installed and stored according to the scale and facilities of each relevant room; and it will be in coordination with construction plans.

4.2 Design Criteria

4.2.1 Criteria for Equipment Selection

The criteria for equipment selection are as follows:

- (1) Equipment for experiment and training will be selected putting a priority on basic training equipment which is necessary for practical application in many fields, in addition to being in concurrence with existing high standards of industrial technology in Thailand.
- (2) Equipment of extremely high technical levels, requiring excessive high tech skills in order to operate and maintain, will be excluded from the Project.

- (3) Equipment will be able to withstand frequent use by students and will be easy to maintain, repair, and inspect.
- (4) Equipment will be commonly used in Thai industrial fields.
- (5) Equipment for video production/editing, audio visual, language lab and printing will be selected from those commonly used and easy to operate.
- (6) Equipment will be selected from those easy to obtain spare parts and consumables and will have a manufacturer's office/agent in Thailand.

4.2.2 Criteria for Determining the Scope of Equipment

The courses of each department utilize the same lab and training facilities. Subsequently, equipment quantity was not determined according to the needs of each department, but according to the location plans for each lab and training facility.

(1) Conditions for Determining Equipment Scope

The scope of the equipment will be determined on the following conditions:

- 1) Although the basic training equipment of each lab and training facility is expected to overlap in many cases, the scope will be determined in such a way as to avoid straining the curriculum or detracting from its educational impact.
- 2) One class at PTC is composed of 40 students for general subjects. Lab and training classes will have 20 students per class.
- 3) Equipment required for basic educational use will be provided for each student and one piece of equipment will be provided for every group composed of two to four students. One unit will be provided as a spare for each class. Two units including one spare will be provided for research and demonstrations by faculty members. Existing equipment will be excluded from the Project.
- 4) It has been estimated that each lab and training facility will be used about 30 hours per week.
- 5) The scope of the equipment will allow installation and storage to conform with the scope and size of the lab and equipment placement plan.

(2) Flow Chart Determining the Scope of Equipment

A flow chart depicting how equipment scope was determined is shown in Fig. 4.1.

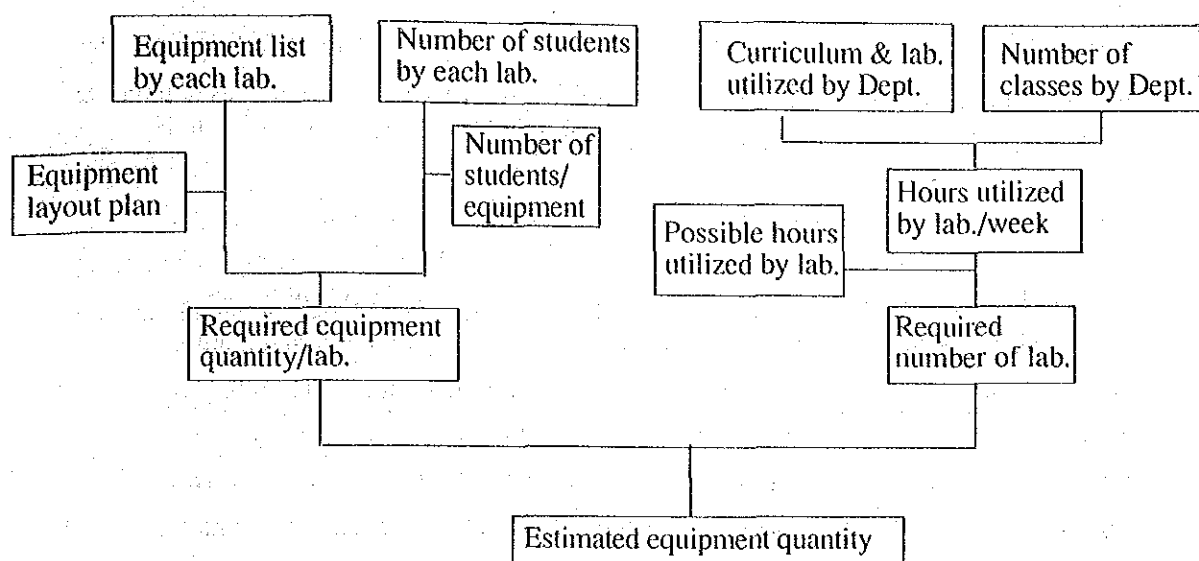


Fig. 4.1 Flow Chart Determining the Scope of Equipment

4.3 Basic Plan

Basic Plan of Project equipment has been formulated in accordance with the Design Criteria shown in article 4.2.1. Equipment to be provided by this project has been selected based on curriculum of each department, lab and training facility. Quantity of the equipment has been decided on the schedule usage of laboratories and training facilities by each subject in order to avoid overlapping of equipment. Coordination with construction plan of the new school building was also taken into consideration in formulating installation plan of the equipment.

4.3.1 Equipment Plan

Policy for equipment selection and major equipment planned according to each laboratory is as follows:

(1) Instrumentation Lab

In this lab students are taught the variety, type, structure, performance, and operation of instruments.

Major equipment includes insulation tester, transistor checker, OHM's law trainer, resistance and potential difference measurement circuit model, etc. These pieces of equipment will be used by the instructor to explain and instruct students; therefore, a supplementary unit will be provided for a total of two units. A total of six, oscilloscopes, galvanometers, DC/AC bridge and electric fundamental training unit,

including supplementary units, to be used by groups of four students will be provided. In addition, other instruments will be provided for every two or four students depending on the frequency of use and will be used alternately.

(2) Electronic Device and Circuit Lab

This lab is used to teach students about general electronic circuit.

Main equipment include rectification circuit trainer, oscillator and amplifier circuit trainer, semiconductor circuit trainer, thyristor trainer, electronic voltmeter, etc. which will be used by groups of four students. One supplementary unit will be provided for a total of six units. Equipment such as the LCR meter and transistor checker are not used very frequently. Therefore, a total of two units (including supplementary unit) will be provided. A total of 12 (including one supplementary unit) commonly used meters, one for every two students and one for instructor use will be provided. In addition, one semiconductor characteristic curve tracer to be utilized by the whole classroom will be furnished.

(3) Digital Electronics & Microprocessor Lab

Digital circuit and principles of micro computers are taught and practically applied in this lab.

As major equipment, two units (including one supplementary unit) of logic circuit trainers will be provided for instructor use in demonstrations. One digital circuit trainer and one logic checker, etc. for every two students will be provided, in addition to one unit for the instructor and one supplementary unit, totaling 12 units. One microcomputer for every student, teacher, and one supplementary unit will be provided for a total of 22 units.

(4) Microcomputer Lab

The principles and operation of peripheral equipment are studied using the microcomputer.

Software machine code of the microcomputer will be produced effectively by a personal computer and then transferred to a microcomputer. Twenty students will be divided into two groups of 10 students. Twelve units each of both microcomputers and personal computers to be used alternately by the students, will allow one unit per two students, one unit for the instructor, and one supplementary unit. As peripheral equipment, six units each of A/D converter board, D/A converter board, printer and stepping motor unit including one for instructors and one as a supplementary unit will be provided.

(5) Personal Computer Lab

Hands on training of personal computers and usage of application software are taught here.

The personal computer is considered a basic educational tool and to improve the effectiveness of the educational content, one unit per student, one unit for instructor use, and one supplementary unit or a total of 22 units per classroom will be provided. Totally 44 units will be provided for two classrooms.

A total of 22 printers for two classrooms or one per two students and one supplementary unit, will be provided.

(6) Computer-Aided Design (CAD) Lab

Methods in computer design, design practice, drawing figures, etc. are taught here.

The CAD/CAM computer, a basic educational tool for elevating educational content, will be provided for every student, including one unit for instructor use and one supplementary unit, for a total of 22 units.

(7) Power Electronics & Electric Drive Lab

Electric motor for mechatronics, etc. are taught here.

One DC servomotor trainer, stepping motor trainer, positioning control/screw drive and wire drive will be provided for every four students; and since they will be used alternately, a total of 3 units including one supplementary unit of each equipment will be provided. Three to six units of meters will be provided according to the frequency of use.

(8) Automatic Control Lab

Basic research in automatic control and use of automation devices actually utilized in industrial fields today is taught in this lab.

The equipment will be utilized by alternating five groups of four students. A total of three units each (including one supplementary unit) of sequence control experimental equipment, temperature servo control units and servo feedback control units, etc. will be provided. A total of six meters, including one supplementary unit, will be furnished to allow each group to use one meter.

(9) Computer Aided Measurement Lab.

Method of controlling instrument and data processing by computer of data collected by various instrument is taught here.

Major equipment includes personal computer, GP-IB board, digital multimeter (GP-IB), oscilloscope (GP-IB), X-Y plotter. This lab is, different from other labs, used by instructors and PTS. The subject is automatic measurement in two fields, electric and mechanical fields. A minimum of 4 computers, etc will be provided to enable measurement in these two fields.

(10) Industrial Electronics Lab

Use of actual electronic instruments employed in industrial fields today is taught.

Major equipment is transistor inverter trainer, robot trainer, robot control computer, FMS educational model, etc. The FMS model will be used by the instructor for demonstration purposes. Only one FMS model will be provided because it is special and costly. Transistor inverter trainer and two types of robot trainers will be alternately used by groups of four students. A total of three units, including one supplementary unit, and six units of robot control computers for each of the robot trainers will be furnished.

(11) Hydraulics & Pneumatics Lab

The function and role of pneumatic and hydraulic equipment and the use of pneumatic and hydraulic control units are taught here.

Major equipment includes basic hydraulic training unit, electro-hydraulic training unit proportional hydraulic training accessory and electro-pneumatic training unit and programmable controller. The number of units to be provided are one, two, three, one and two respectively so as to make the total of three units each taking into consideration the supplementary one and existing units.

Experiment will be carried out using those 5 kinds of equipment by groups of four students.

(12) Transducer Lab

The use of sensors which are currently used in the industrial sector, the principles of transducer equipment, and use of instrumentation methods is taught.

Major equipment is instrumentation transducer unit and instruments for measuring pressure and velocity. Research is carried out by groups of four students. A total of three instrumentation transducer units will be provided since two types of experiments will be conducted. A total of five diaphragm seals and integral flow orifice for DPT, will

be furnished. One unit for every four students will be available. However, ten orifice plates with ring will be provided because two orifice plates will be utilized per one experiment.

(13) Industrial Instrumentation Lab

Industrial instrumentation analysis, control, and maintenance by electric and pneumatic circuits, and measuring, inspection, testing, and problem solving actually carried out in the industrial sector today is taught.

Students assemble pipelines, attach instruments using electronic and pneumatic circuits to make control systems in this lab. Therefore, the quantity of equipment which will be provided for this lab will exclude existing equipment required for this system.

Major equipment is sensor, PID pneumatic controller/electronic controller, pneumatic recorder, electric controller, thermocouple with EME/RTD-EMF, control valves.

(14) Process Control Lab

In the present industrial world, controllers of the production line of industrial plants and air conditioning system is concentrated and controlled in the central control room. This lab is the training ground for learning intensive operation and maintenance systems and the functions and operation of all instruments.

Major equipment includes two units of universal station, one unit of process manager and two units of programmable controller which were already purchased. However, since the equipment cannot function as an integrated system by themselves, one highway gateway, application module, advanced multifunction controller and logic controller will be provided so as to make the system functional.

(15) CNC Machining Workshop

Operation and maintenance of modern high tech machine tools are taught in this workshop. There are also plans to intensively teach students programming of CAD/CAM in conjunction with the use of these high tech machine tools.

Major equipment includes CNC wire-cut discharge machine, CNC milling machine, CNC precision surface grinding machine, CAD/CAM computer, and industrial robot. There are currently two CNC machines in the workshop. Three additional new machines will be provided making a total of five. These five machines will be used alternately by groups of four students. One CAD/CAM computer will be used with the three aforementioned CNC machines and also used to transfer control programs of

one industrial robot. One computer will be sufficient, for these are to transfer data made in Computer Aided Design Lab.

(16) Metrology Lab

The principle and operational skills in precision measuring instruments used in manufacturing by machine tools are taught in this lab.

Major equipment includes coordinate measuring machine, roundness tester, surface roughness tester and microscope. One unit of each equipment will be used in each class. Students utilizing the granite surface plate and the measuring instruments were divided into five groups, four students per group.

Therefore, five units of third rank equipment will be provided for the granite surface plate and the V block. Two to five measuring instruments will be provided according to frequency of use.

(17) Telecommunications Lab

Theory and actual use of microwave and optical fiber communications are taught in this lab.

Major equipment includes optical fiber demonstration and training set and microwave link demonstration and training set. As for optical fiber demonstration and training set, in order to enable groups of four students to conduct five kinds of experiments alternately, six units each of basic equipment and two to three units of those which can be shared will be provided.

Three microwave trainers to be used alternately combining with other training by four students per group will be provided.

(18) Video Production Studio

This studio will be used to produce educational material and major equipment include video camera, lighting, VTR, stereo cassette deck, microphone, editing VTR, monitor, speakers, announcer's booth, dubbing VTR, video tapes, etc. The equipment will not be highly sophisticated, but functional for general educational use.

(19) Auditorium

Major equipment include video projector, screen, speakers, microphone, audio system, etc. functional for general educational use.

(20) Audio Visual Room

Major equipment include video projector, screen, speaker, VTR, monitor, audio mixer, etc. functional for general educational use.

(21) Text Printing Room

Major equipment which will be provided is duplicator, bookbinding machine, word processor, and copy machine. The duplicator will have platemaking functions which can be operated at a low cost; and two units, including one supplementary unit, will be provided. One unit of the bookbinding machine and copy machine able to withstand heavy use will be provided in accordance with frequency of use. One word processor will be provided to improve effectiveness of document production which is currently conducted by manual typewriter.

(22) Language Lab (LL)

The language lab will accommodate 40 students. Major equipment includes master console and booths for 40 people. The master console will be provided with a master controller, tape recorder, and headset. Each booth will contain easy to operate tape recorder and headset. In addition, video projector, screen, VTR, monitor, speaker, audio mixer will be provided so as to improve the effectiveness of lectures.

(23) The Number of Labs and Workshops

The number of hours utilized in the labs and workshops in a week by each department is shown in Appendix 2.8 - 2.10. Each lab and workshop will be utilized 30 hours per week (five days). However, utilization hours are planned longer in some labs. These labs are shown below.

Electronic Device and Circuit Lab (ECL)

Digital Electronics & Microprocessor Lab (DML)

Personal Computer Lab (PCL)

Power Electronics & Electric Drive Lab (PEL)

Language Lab (LL)

As PCL definitely requires two rooms, the Project will provide equipment for two rooms. LL can utilize the existing room which is now used by seven departments not included in the Project, by adjusting the curriculum.

The remaining three ECL, DML and PEL labs will also utilize only one room according to Project operation plans, although utilization hours of these labs exceed by the maximum of six hours per a week. Therefore, it is necessary to study present curricula or the possibility of extending the working days of a department/a subject from the present five days a week to six days, in order to reduce daily utilization hours of these labs.

Equipment to be provided by the Project is shown in the following pages; equipment for experiment and training is classified according to each lab and supplementary equipment is classified according to the rooms where it will be utilized.

Table 4.1 Equipment List

I. INSTRUMENTATION LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
IL-01	Multi Tester (analog)	12	Measurement of Voltage, current and resistance
IL-02	Multi Tester (digital)	12	Measurement of current and voltage
IL-03	Galvanometer (0.9 μ A \pm 10%)	6	Indicate and Measurement of tiny current
IL-04	AC Wattmeter (0.2/1A)	6	Measurement of alternating electric power
IL-05	AC Wattmeter (1/5A)	2	Measurement of alternating electric power
IL-06	Clip-on Meter (AC 0-350A)	2	Measurement of simplify current in wires
IL-07	Portable DC Voltmeter (0.3V-30V)	12	Measurement of DC voltage
IL-08	Portable DC Voltmeter (3V-300V)	12	Measurement of DC voltage
IL-09	Portable DC Ammeter (0.3mA-30mA)	12	Measurement of DC current
IL-10	Portable DC Ammeter (10 mA-1000mA)	12	Measurement of DC current
IL-11	Portable DC Ammeter (0.3A-30A)	12	Measurement of DC current
IL-12	Portable AC Ammeter (0.25A-1A)	12	Measurement of AC current
IL-13	Portable AC Ammeter (1A-5A)	6	Measurement of AC current
IL-14	Portable AC Ammeter (5A-25A)	6	Measurement of AC current
IL-15	Portable AC Voltmeter (3V-15V)	12	Measurement of AC voltage
IL-16	Portable AC Voltmeter (15V-75V)	12	Measurement of AC voltage
IL-17	Fluxmeter (10 ² -10 ⁵ K Maxwell)	2	Detection of flux
IL-18	Insulation Tester (50-2000M Ω)	2	Measurement of insulation resistance (battery type)
IL-19	Insulation Tester (500V/100M), Hand Drive	2	Measurement of insulation resistance (generation type)
IL-20	Surface Thermometer (-10 to 600°C)	2	Measurement of surface temperature
IL-21	Earth Tester (0-1000 Ω)	2	Measurement of earth resistance
IL-22	Electronic Voltmeter (10Hz-1MHz)	6	Measurement of voltage
IL-23	Digital Multimeter (AC/DC 0-1000V)	6	Detailed measurement of current and voltage
IL-24	Dual Trace Oscilloscope (20 MHz)	6	Observation of wave-form of electric circuit
IL-25	LCR Meter (100-100kHz)	1	Measurement of electric element dimensions
IL-26	Universal Counter (100-120MHz)	6	Measurement of frequency and period
IL-27	Function Generator (0.1-1.0MHz)	6	Signal source of electric circuit (square-wave)
IL-28	RC Oscillator (5 Hz-500kHz)	6	Signal source of electric circuit (sine-wave)
IL-29	Transistor Checker (0.1-199.9 μ A)	2	Check of transistor quality
IL-30	OHM's Law Trainer (Parallel/Series)	2	Study of OHM's law
IL-31	Resistance and Potentio difference measurement circuit model (0.001-2.0V)	2	Study of Resistance and Potentio difference
IL-32	Oscilloscope Trainer (Six kind of experiments)	6	Study of operation of Oscilloscope
IL-33	Electric Fundamental Training Unit (Voltage, Current and Resistance)	6	Tool for electric fundamental measurement
IL-34	DC Bridge (1 Ω -10M Ω)	6	Measurement of DC resistance
IL-35	AC Bridge (0.1 Ω -50K Ω)	6	Measurement of impedance
IL-36	Regulated DC Power Supply (0-18V, 1A)	12	Power source of circuit for experiment
IL-37	Regulated DC Power Supply (0-35V, 0.5A)	12	Power source of circuit for experiment
IL-38	Bread Board	22	Assembling base of electric wiring

2. ELECTRONIC DEVICES AND CIRCUIT LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
ECL-01	Multi Tester (analog)	6	Measurement of current and resistance (analog)
ECL-02	Multi Tester (digital)	6	Measurement of current and resistance (digital)
ECL-03	Portable DC Voltmeter (0.3V-30V)	12	Measurement of DC voltage
ECL-04	Portable DC Voltmeter (3V-300V)	12	Measurement of DC voltage
ECL-05	Portable DC Ammeter (30-3000 μ A)	6	Measurement of DC current
ECL-06	Portable DC Ammeter (0.3mA-30mA)	12	Measurement of DC current
ECL-07	Portable DC Ammeter (10mA-1000mA)	12	Measurement of DC current
ECL-08	Portable DC Ammeter (0.3A-30A)	6	Measurement of DC current
ECL-09	AV Wattmeter (0.2/1A)	6	Measurement of AC electric power
ECL-10	Electronic Voltmeter (10Hz-10MHz)	6	Measurement of AC voltage
ECL-11	Electronic Voltmeter (2ch, 10Hz-1MHz)	6	Measurement of AV voltage
ECL-12	Dual Trace Oscilloscope (20MHz)	6	Observation of wave form
ECL-13	Dual Trace Oscilloscope (40 MHz)	6	Observation of wave form
ECL-14	Digital Storage Oscilloscope (20 M sample/s)	2	Observation of instantaneous wave form
ECL-15	Digital Multimeter	6	Measurement of current, resistance and voltage
ECL-16	Universal Counter (100-120MHz)	6	Measurement of frequency and cycle
ECL-17	Function Generator (0.1-1.0MHz)	6	Signal source of electric circuit
ECL-18	LCR Meter (100-100kHz)	2	Measurement of electric element dimensions
ECL-19	Semiconductor Characteristic Curve Tracer (Max. 1600V)	1	Display of characteristic of Semiconductor
ECL-20	RC Oscillator (5Hz-500kHz)	6	Signal source of electric circuit
ECL-21	Transistor Checker (0.1-199.9 μ A)	2	Check of transistor quality
ECL-22	Amplifier Circuit Trainer (2 & 3 terminal elements semiconductor, control power source 5-10V)	6	Characteristic Measurement of diode and transistor
ECL-23	Amplifier Circuit Trainer (Training kit for Bias determination, double amplifier circuit and power amplifier circuit)	6	Study of amplifier circuit
ECL-24	Oscillator/Modulation Circuit Trainer (Training kit for Collector tuning, CR type Oscillator and Collector modulating circuit)	6	Study of oscillator and AM modulation circuit
ECL-25	Rectification and Smoothing Circuit Training Unit (Training kit for Half/full rectifier circuit and Smoothing circuit)	6	Study of electric circuit
ECL-26	Pulse Circuit Trainer (Training kit for Differentiation/Integration circuit, Clipping/Clamping circuit, Logic circuit, Miller/bootstrap circuit and Multivibrator, 13 kind elements)	6	Study of pulse circuit
ECL-27	Thyristor Trainer [Training] (Training for study the operation, principle of Thyristor circuit and Non- contact switching exercise of DC/AC circuit)	6	Fundamental experiment for thyristor circuit
ECL-28	Thyristor Trainer [Demonstration] (Training kit for exercise of Automatic voltage control for AC/DC dynamos and Thyristor inverter exercise)	2	Application experiment for thyristor circuit
ECL-29	Regulated DC Power Supply (0-18v, 1A)	12	Power source of experimental circuit

No.	DESCRIPTION SPECIFICATION)	QTY	PURPOSE OF USE
ECL-30	Dual-tracking DC Power Supply ($\pm 18V$, 1A)	12	Power source of experimental circuit
ECL-31	Slide Voltage Regulator (0-260V, 0.2KVA)	6	Variable voltage for AC input
ECL-32	Slide Variable Resistance (120W, 3000/750 Ω)	6	Load resistance for power source circuit
ECL-33	Bread Board	12	Assembling base of electric circuit

3. DIGITAL ELECTRONICS AND MICROPROCESSOR LABORATORY

No.	DESCRIPTION SPECIFICATION)	QTY	PURPOSE OF USE
DML-01	Logic Circuit Trainer (400 block element)	2	Demonstration of logic circuit
DML-02	Single Board Microcomputer Trainer (CPU, Z80)	22	Study of microcomputer software
DML-03	Digital Circuit Trainer (Training kit for Logic circuit, Assembly and operation training of half/full adder and encoder/decoder, Basic operation training of R-S, J-K flip flaps and shift registers)	12	Study of digital circuit
DML-04	Logic Checker (0.6-2.2V)	12	Check of logic circuit
DML-05	Multi Tester (Digital)	12	Measurement of current and resistance (digital)
DML-06	Dual Trace Oscilloscope (40MHz)	12	Observation of logic circuit wave form
DML-07	IC Tester (Max. 16pin IC)	2	Inspection of IC
DML-08	Function Generator (0.1-1 MHz)	2	Signal source of clock pulse
DML-09	Switching Power Supply (5V, 12V)	12	Signal source of TTL circuit
DML-10	Regulated DC Power Supply (0-18V, 1A)	12	Power source of experimental circuit
DML-11	Bread Board	12	Assembling base of electric wiring

4. MICROCOMPUTER LABORATORY

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
ML-01	Single Board Microcomputer (CPU, Z80)	12	Application experiment for micro computer
ML-02	Parallel I/O Board	12	Experiment of parallel I/O data
ML-03	Relay, Photo Coupler Board (Relay Output 2ch, Photo Input 4ch)	6	Experiment of rely and photo coupler I/O
ML-04	Stepping Motor Control Board	6	Experiment of stepping motor control
ML-05	Stepping Motor Unit (3W)	6	Experiment unit of stepping motor
ML-06	A/D Converter Board (1ch 8bit)	6	Experiment for analog to digital convert
ML-07	D/A Converter Board (1ch 5bit)	6	Experiment of digital to analog convert
ML-08	Serial Communication Board	12	Signal recipient board to personal computer
ML-09	Mother Board and Connector Set	12	Connection for application universal board
ML-10	Switching Power Supply (5V/6A, +12V/2.5A, -12V/0.5A)	12	Power source for micro computer experiment
ML-11	Emulator (Memory 64KB)	6	Simulation of computer circuit
ML-12	Personal Computer (16bit 1MB RAM)	12	Software development for computer experiment

No.	DESCRIPTION (SPECIFICATION)	Q'TY	PURPOSE OF USE
ML-13	CRT (14in.)	12	
ML-14	Printer (80 Characters/Line)	6	
ML-15	Printer Selector w/cable	6	
ML-16	Soft Ware for Z-80	10	Editor and cross assembler
ML-17	Logic Checker (Max. 30MHz)	2	Signal check for micro computer
ML-18	Digital Multi Tester	6	Measurement of voltage
ML-19	Logic Analyzer (32 Channel)	2	Signal analysis for micro computer
ML-20	Dual Trace Oscilloscope (20 MHz)	6	Observation of wave form of D/A convert
ML-21	Function Generator (0.1-1 MHz)	6	Signal source for A/D convert

5. PERSONAL COMPUTER LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	Q'TY	PURPOSE OF USE
PCL-01	Personal Computer (16bit 1MB RAM)	44	Study of computer programming
PCL-02	CRT (14 in.)	44	
PCL-03	Hard Disk (40 MB)	2	For teacher
PCL-04	Printer (80 Characters/Line)	22	
PCL-05	Printer (120 Characters/Line)	2	For teacher
PCL-06	Printer Selector W/Cable	22	
PCL-07	Software Set	1 set	
	1) LOTUS 1-2-3	2	Table calculation
	2) Fox Base	2	Data base
	3) WORDSTAR	2	Word processor in English
	4) CU WRITER	2	Word processor in English
	5) Basic Compiler	21	Study for BASIC
	6) C Compiler	21	Study for C language
PCL-08	Table for Personal Computer	22	
PCL-09	Data Display (Display 200mmx160mm)	2	OHP presentation of CRT data
PCL-10	OHP w/Screen (Magnification 3.5-14.0)	2	OHP presentation of data

6. COMPUTER AIDED DESIGN LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	Q'TY	PURPOSE OF USE
CAD-01	CAD Computer (student)	21	Practice for CAD
	1)CPU 32 bits with Math Co-processor		
	2)Mouse		
	3)40 MB Hard Disk		
	4)5.25 and 3.5 inch disk drive		
	5)CRT (14 in., Color)		
	6)2MB RAM		
CAD-02	CAD computer (teacher)	1	Training for CAD
	1)CPU 32 bits with Math Co-processor		
	2)Mouse		
	3)80MB Hard Disk		
	4)5.25 and 3.5 inch disk drive		

No.	DESCRIPTION SPECIFICATION)	QTY	PURPOSE OF USE
	5)CRT (20 in., Color)		
	6)4MB RAM		
CAD-03	CAD/CAM Software	1set	
	1)Mechanical Drawing and Design	21	Software for mechanical drawing
	2)Electrical Drawing and Design	21	Software for electrical circuit drawing
	3)Civil Drawing and Design	21	Software for civil drawing
CAD-04	Printer (120 characters/line)	11	
CAD-05	Laser Printer (240dpi)	2	
CAD-06	Image Scanner (A4)	2	
CAD-07	X-Y Plotter (A3)	6	
CAD-08	X-Y Plotter (A0)	1	
CAD-09	Digitizer (A3)	6	
CAD-10	UPS Unit (10KVA, 10min.)	1	Protection for electric break down
CAD-11	Table for CAD Computer	21	
CAD-12	Data Display 200x160mm)	1	OHP presentation of CRT data
CAD-13	OHP w/Screen (Magnification 3.5-14.0x)	1	OHP Presentation of data

7. POWER ELECTRONICS AND ELECTRIC DRIVES LABORATORY			
No.	DESCRIPTION SPECIFICATION)	QTY	PURPOSE OF USE
PEL-01	DC Servomotor Trainer (Training kit for principle of DC servomotor and positioning control)	3	Study for DC servomotor
PEL-02	Stepping Motor Trainer (Training kit for excitation of the stepping motor and positioning control)	3	Study for stepping motor
PEL-03	Positioning Control/Wire Drive (Training kit for positioning control/wire drive by sensor)	3	Practice for positioning control
PEL-04	Positioning Control/Screw Drive (Training kit for positioning control/screw drive by sensor)	3	Practice for positioning control
PEL-05	Pneumatic Control Simulator (Training kit for composition and mechanism of pneumatic control of handling, sequence and program control)	3	Study for Pneumatic Control Simulator
PEL-06	Air Source (300W)	3	Compression air source for operation
PEL-07	Portable DC Voltmeter (0.3-30V)	3	Measurement of DC voltage
PEL-08	Dual Trace Oscilloscope (20 MHz)	3	Observation for wave form of two channel
PEL-09	Universal Counter (120 MHz)	6	Measurement of frequency and cycle
PEL-10	Regulated DC Power Supply (0-18V, 1A)	3	Power Supply for electric circuit control

8. AUTOMATIC CONTROL LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
AL-01	Sequence Control Experimental Equipment (Training for relay, timer and delay circuit)	3	Experiment for sequence control
AL-02	Temperature Servo Control (Training kit for PID control of temperature, temperature range 6-60°C, 500W heater)	3	Study for servo-feedback control
AL-03	Servo-Feedback Control Trainer (Training for assembling of Servo-feedback fundamental circuit, automatic-balancing and negative return action by Potentiometer, 12V, 3W motor)	3	Study for servo-feedback control
AL-04	AD/DA Converter (8bit)	6	Transmitter experiment of AD/DA
AL-05	Sequencer [Controller] (input 20, output 16)	6	Experiment for sequence control (AL-02, AL-03)
AL-06	Sequencer [Programmer] (48 input key)	6	Experiment for sequence control (AL-02, AL-03)
AL-07	Sequencer [Memory] (Cassette type)	30	Experiment for sequence control (AL-02, AL-03)
AL-08	Function Generator (0.1-1 MHz)	6	Signal source of experimental circuit
AL-09	Dual Trace Oscilloscope (20 MHz)	6	Observation of wave form
AL-10	X-Y Recorder, w/Time Base (A4, 1 ch.)	3	Recording for temperature curve
AL-11	Tachometer (30-50,000 r.p.m.)	3	Measurement of revolution
AL-12	Regulated DC Power Supply (0-18V, 1A)	6	Power source for electric circuit control
AL-13	Portable DC Voltmeter (0.3V-30V)	12	Measurement of DC voltage
AL-14	Digital Multi Tester	6	Measurement of voltage

9. COMPUTER AIDED MEASUREMENT LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
CML-01	Personal Computer (32bit 2MB RAM)	4	Control for measurement equipment
CML-02	CRT (14 in.)	4	Display for computer
CML-03	Printer (80 characters/line)	2	
CML-04	X-Y Plotter (A3, RS-232C)	1	
CML-05	Board for Personal Computer		Control for instrument and signal I/O
	1) GP-IB Board	4	Control for instrument
	2) Parallel I/O Board	2	Parallel I/O
	3) I/O Connector Block	2	Terminal for parallel I/O
	4) A/D, D/A Board	2	Convertor for A/D and D/A
	5) Software for A/d, D/A Board	2	
CML-06	GP-IB Cable (1m)	5	Connection cable
CML-07	GP-IB Cable (2m)	5	Connection cable
CML-08	Oscilloscope (100 MHz)	2	Observation of wave form
CML-09	Oscilloscope (100 MHz, 4ch, GP-IB)	1	Observation of wave form
CML-10	Universal Counter (1mHz-1300 mHz, GP-IB)	2	Measurement of frequency and cycle
CML-11	Standard Signal Generator [FM/AM] (100k-110MHz, GP-IB)	2	Signal source of high frequency circuit
CML-12	Audio Analyzer (5-200kHz, GP-IB)	2	Characteristic analysis of audio apparatus
CML-13	FFT Analyzer [w/signal output card] (1-100kHz, GP-IB)	2	Frequency analysis of low frequency
CML-14	Color Plotter (4pen, A3)	1	Hard-copy of FFT display

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
CML-15	Sound Level Meter (w/RS232C, cable, 1/3 octave)	2	Measurement of sound pressure
CML-16	Spectrum Analyzer (10kHz-3.5 GHz, GP-IB)	2	Frequency analysis of high frequency
CML-17	Tracking Generator for Spectrum Analyzer(100kHz-2GHz)	2	Oscillation for Spectrum Analyzer
CML-18	Dipole Antenna (25MHz-1000MHz)	1	Measurement of electric field
CML-19	Digital Multimeter (GP-IB)	2	Measurement of current, resistance and voltage
CML-20	Function Generator (20MHz GP-IB)	1	Signal source of electric circuit
CML-21	LCZ Meter (100-100kHz,GP-IB)	2	Characteristic Measurement of electric circuit
CML-22	Variable Frequency Filter (1-99 kHz, GP-IB)	1	Experiment of frequency characteristic
CML-23	X-Y Recorder (w/time Base, A4 1ch)	1	Hard-copy of spectrum analyzer
CML-24	Torquemeter (20-5000g.cm, GP-IB)	2	Measurement of shaft-torque of smallish motor

10. INDUSTRIAL ELECTRONICS LABORATORY

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
IEL-01	Transistor Inverter Training Unit (Output 1KVA, 50-60Hz)	3	Study of DC-AC conversion
IEL-02	Robot Model (5 Axes, Air hand Type)	3	Study of multi joint robot
IEL-03	Three Dimensions Robot (3 Axes, Travel 420-300 mm)	3	Study of three dimensions robot
IEL-04	Personal Computer (16bit 1MB RAM)	6	Computer for robot control
IEL-05	CRT (14")	6	
IEL-06	Printer, (80 Characters/Line)	2	
IEL-07	Printer Selector w/Cable	2	
IEL-08	Flexible Manufacturing System [FMS] (Multijoint robot, NC Milling machine, Belt conveyer, Sensor, PC, Rack)	1	Experiment of FMS
IEL-09	Dual Trace Oscilloscope (20 MHz)	3	Observation of wave form
IEL-10	Multi Tester (Digital)	3	Measurement of current and voltage

11. HYDRAULICS AND PNEUMATICS LABORATORY

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
HPL-01	Basic Hydraulic Training Unit (Basic/Advance parts, operating press. 60Bar, 1.5KW, operation by oil press. relay)	1	Study of basic hydraulic control
HPL-02	Electro-Hydraulic Training Accessory (Basic/Advance parts, operating press. 60Bar, 1.5KW, operation by electric relay)	2	Study of electro-hydraulic control
HPL-03	Proportional Hydraulic Training Accessory (Basic/Advance parts, operating press. 60Bar, 1.5KW, operation by electric sensor)	3	Study of proportional hydraulic control
HPL-04	Electric Pneumatic Training Unit (Basic/Advance parts, operating press. 3-8Bar, 1.5KW, operation by electric relay)	1	Study of electric pneumatic control

No.	DESCRIPTION	QTY	PURPOSE OF USE
HPL-05	Programmable Controller (Basic/Advance parts, operating press. 3-8Bar, 1.5KW, operation by electric relay, PC 16bit 1MB RAM)	2	Study of programmable control
HPL-06	Air Compressor (Screw Type, 11KW)	1	Supply of compressed air
HPL-07	Air Receiver (0.15 cubic meter)	1	Storage of compressed air
HPL-08	Refrigerated Air Dryer (300W)	1	Dryer for air
HPL-09	Main Line Filter (3μ)	1	Elimination of air dust

12. TRANSDUCER LABORATORY			
No.	DESCRIPTION	QTY	PURPOSE OF USE
TL-01	Instrumentation Transducer Unit (Experiment table 2sets, Instrument of microswitch operation 2units, Sensor 11 pcs.)	3	Study of instrumentation transducer
TL-02	Orifice Plate with Ring, Integrated Ring, Holding Ring (15-30mmø Pipe)	10	Study of pressure transmitter
TL-03	Diaphragm Seals for Pressure Transmitter/DPT (25mmø)	5	Study of pressure transmitter
TL-04	Integral Flow Orifice for DPT	5	Study of integral flow orifice

13. INDUSTRIAL INSTRUMENTATION LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
IIL-01	Thermocouple Set (K,E,J,T type)	6	Study of thermocouple
IIL-02	Digital Thermometer (-200 to 1,000°C)	6	Measurement of temperature
IIL-03	Digital Multimeter	6	Measurement of voltage and current
IIL-04	Pneumatic Square Root Extractor (In/Output 0.2-1.0kg/cm ²)	1	Study of control system
IIL-05	Electronic Square Root Extractor (In/Output 4-20mA)	2	Study of control system
IIL-06	Pneumatic Recorder (3pens, Input 0.2-1.0kg/cm ²)	1	Recording of data
IIL-07	Pneumatic Controller [PID] (In/Output 0.2-1.0kg/cm ²)	1	Display of data
IIL-08	Pneumatic d/p Transmitter (0-50,000mmH ₂ O)	1	measurement of pressure transmitter
IIL-09	Electronic Controller (Programmable, Input 11 points, Output 10 points)	1	Study of electronic automatic controller
IIL-10	Electronic Recorder (Input 12 points, Input DC Voltage, thermocouple, thermistor)	1	Recording of data
IIL-11	Pressure Regulator (6mmø, 0.1-7.0 kg/cm ²)	12	Generation of pressurized air
IIL-12	Filter/Regulator (6mmø, 0.1-7.0 kg/cm ²)	12	Generation of pressurized air (filter)
IIL-13	Pressure Gauge (0-20 kg/cm ²)	18	Measurement of air pressure
IIL-14	Liquid Column Manometer (0-800mm)	3	Measurement of air pressure
IIL-15	Pneumatic Pressure Transmitter (Measuring range 0-50 to 0-700 kg/cm ²)	1	Study of pneumatic pressure transmitter

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
III-16	Thermocouple with EME/RTD-EMF (Input DC 2.5-100mmV Output 0.2-1.0 kg/cm ²)	1	Measurement of temperature
III-17	Electronic Temperature Transmitter (Temperature range 0-1,700 °C, output -50 to 220mmV DC)	1	Study of electronic temperature transmitter
III-18	Control Valve (Pneumatic, 25mmø, 1.2-4.0 kg/cm ²)	4	Adjustment of air flow
III-19	Current to Pneumatic Converter (Input 4-20 mmA DC, Output 0.2-1.0 kg/cm ²)	4	Transmission of measurement data
III-20	Pneumatic to Current Converter (Input 0-1.0 kg/cm ² , Output 4-20 mmA DC)	4	Transmission of measurement data
III-21	Vortex Flowmeter (25 mmø, 4-20mmA)	1	Measurement of air flow speed
III-22	Magnetic Flowmeter(25 mmø, 0-10mm/s)	2	Measurement of air flow volume

14. PROCESS CONTROL LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
PRO-01	Distributed Control Trainer		Study of process control system of equipment
	1) Highway Gateway	1	
	2) Application Module	1	
	3) Advanced Multifunction Controller	1	
	4) Logic Controller System	1	
	5) Cables & Connector	1	

15. CNC MACHINING WORKSHOP			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
CNC-01	CNC Wire Cut Electric Discharge Machine (Table travel X•Y axes 300•200mm, Z axis 180mm, Max. Size of work piece 400x300x175mm, Wire dia. feed speed 0.1- 0.3mmø, 0-15m/min, Power supply 12KVA)	1	Study of computerized machine tool
CNC-02	CNC Milling Machine (Table 1050x400mm, Table travel X•Y•Z axes 710x400x360mm, Cutting feed speed 0.1-2400mm/min, Power supply 15KVA)	1	Study of computerized machine tool
CNC-03	CNC Precision Surface Grinding Machine (Table 550x200mm, Longitudinal Travel•feed speed 650mm•0.3-25m/min, Z•Y axes travel 230•360mm, Z•Y axes jog feed speed 0-790mm/min, Grinding wheel 205mmøx3000rpm, Power supply 11KVA)	1	Study of computerized machine tool

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
CNC-04	Handling Robot (6 axes, Articulated type, Electric servo drive by Servo motor, Max. load capacity at wrist 5kg)	1	Study of robot operation
CNC-05	Necessary Accessories for Robot (Common base, Turn table, Safety fence, Control panel)	1	
CNC-06	CAD/CAM Computer (32bit 2MB RAM)	1	Transmittal for CNC machine control data
CNC-07	CAD/CAM Software (Mill, Turn, Cut, Drill, Cut Surface, Digitizer)	1	
CNC-08	UPS Unit (2KVA)	1	Power source for computer
CNC-09	Table for Computer (CAD/CAM)	1	

16. METROLOGY LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
MET-01	Coordinate Measuring Machine (Measuring range X•Y•Z axes 500x400x300mm, Min. Scale 0.0005mm, Data processing unit)	1	Study of measurement
MET-02	Roundness Tester (Rotating accuracy 0.04+3H/10000µm <H:Measured height mm>, Table dia. 165mm, Speed of rotation 4rpm, Printer)	1	Measurement of roundness
MET-03	Surface Roughness Tester (Measuring range/Resolution 2- 150µm/0.001-0.1µm, 8-600µm/ 0.002-0.2µm, Magnification: Vertical 1 x to 2,000x, Horizontal 200 x to 200,000 x, Data processing unit)	1	Measurement of surface roughness
MET-04	Tool Microscope (Workpiece stage size 300x240mm, Eyepiece 10x, 20x, Objective 3x)	1	Observation of tools
MET-05	Gauge Block (Grade 1, 110 piece)	2	Foundation of r measurement
MET-06	Granite Surface Plate [1] (750x500x130mm)	5	Foundation of measurement plate(high class)
MET-07	Granite Surface Plate [2] (40x225x20mm x 2)	5	Foundation of measurement plate (middle class)
MET-08	Granite Surface Plate [3] (75x450x40mm x 2)	5	Foundation of measurement plate (low class)
MET-09	Granite V-Block [1] (75x75x75mm x 2)	5	Foundation of measurement plate (high class)
MET-10	Granite V-Block [2] (50x50x65mm x2)	5	Foundation of measurement plate (middle class)
MET-11	Granite V-Block [3] (150x150x150mm x2)	5	Foundation of measurement plate (low class)
MET-12	Digital Count Height Gauge [1] (Measuring range 0-600mm Resolution 0.001mm)	1	Measurement of height (high class)

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
MET-13	Digital Count Height Gauge [2] (Measuring range 0-600mm Resolution 0.01mm)	1	Measurement of height (low class)
MET-14	Height Master (Measuring range 5-300mm Resolution 0.001mm)	1	Measurement of height
MET-15	Test Indicator (Range 0-0.2mm)	5	Indicator for measurement
MET-16	Digital Indicator (Range 12mm, Resolution 0.001mm)	5	Indicator for measurement
MET-17	Bore Gauge (Range 35-150mm)	2	Measurement of inside diameter
MET-18	Inside Micrometer (Range 50-150mm)	2	Measurement of inside diameter
MET-19	Outside Micrometer (Range 0-300mm)	2	measurement of outside diameter
MET-20	Screw Thread Micrometer (Range 0.6-3.0mm)	2	Measurement of screw thread

17. TELECOMMUNICATION LABORATORY			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
TEL-01	Optical Fiber Communication Training Set		Study of basic optical fiber communication
	1) He-Ne Laser (Wave length 632.8nm)	6	Light source
	2) White Light Source (Wave length 400-1,800nm)	6	Light source
	3) Object Lens for Microscope (20x)	6	Microscope
	4) Mechanical stand (X•Y•Z axes travel 30mm)	30	Stand
	5) X Axis Mechanical Stage (90x90mm, travel ± 7.5 mm)	30	Stand
	6) Mirror holder (54mm ϕ)	30	Supporter for mirror
	7) Optical Fiber Core Model (40 ϕ x400mm)	1	Study of optical fiber theory
	8) Optical Fiber Set for Measuring Wave Length Loss	6	Measurement of Transmission loss by wave
	9) Optical Fiber Set for Measuring Transmission Loss	6	Measurement of optical fiber Transmission loss
	10) Optical Spectrum Analyzer (Wave length 400-1,750nm)	2	Measurement of optical spectrum
	11) Semi-conductor Laser Source (Wave length 1,310nm)	3	Light source
	12) X-Y Recorder w/Time base (180x250mm)	3	Recording of measurement data
	13) PWM/PFM Modulator (Input 0-5 VDC, Output 10-10kHzTTL)	3	Experiment of trans signal
	14) PWM/PFM Demodulator (Input 10-10kHzTTL, Output 5m-5VDC)	3	Experiment of trans signal
	15) O/E Converter (Input 540-920nm, Output 0-5VDC)	6	Exchange from optical to electron
	16) E/O Converter (Input 0-5VDC, Output 10 μ W)	6	Exchange from electron to optical
	17) Optical Power Meter (Wave length 400-1100nm)	6	Measurement of optical power
	18) Low Frequency Oscillator (0.01-1MHz)	3	Signal source for Transmission
	19) Long Optical Fiber	6	Experiment optical trans
	20) Plastic Optical Fiber	12	Experiment of optical trans
	21) Optical Connecting Adopter	12	Connection of optical fiber
	22) Regulated DC Power Supply (18V, 1A)	6	Power source of experiment

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
TEL-02	Microwave Link Demonstration and training Set (9.3-9.5GHz)	3	Study of basic micro wave measurement
TEL-03	Gun Oscillator (X-band, 20-30mW)	3	Generation of micro wave source
TEL-04	Crystal (9.1-9.6GHz)	15	Micro wave detect
TEL-05	Digital Multi Tester	6	Measurement of voltage
TEL-06	DC Ammeter (30 ~ 300 μ A)	3	Measurement of DC current
TEL-07	Dual Trace Oscilloscope (20MHz)	6	Observation of wave form
TEL-08	Function Generator (0.1-0.13MHz)	3	Signal source for transmission

18. VIDEO PRODUCTION STUDIO			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
VP-01	3-CCD Color Video Camera (330,000 elements)	2	Video camera for producing text
VP-02	Tripod with Dolly	2	Tripod for video camera
VP-03	S-VHS Portable Video Cassette Deck (Horizontal resolution 400 lines, Tape 1/2 inch)	2	Recording of video tape
VP-04	Portable Color Video Monitor (6" color)	2	Display for video camera
VP-05	Portable Stereo Cassette Deck	2	Recording of audio sound
VP-06	Dynamic Microphone (50-15,000Hz)	2	Collection of surrounding sound
VP-07	Electret Condenser Microphone (20-12,000Hz)	2	Collection of teacher's voice
VP-08	Battery Lighting Kit (200W)	2	Lighting (battery)
VP-09	Portable Lighting Kit (1KW, 650W)	2	Lighting (AC)
VP-10	S-VHS Editing Video Cassette Recorder (Horizontal resolution 625 lines, Tape 1/2 inch, Voice 4ch)	3	Editing recorder for video tape
VP-11	Editing Controller	1	Editing for video tape
VP-12	Video/Audio Switcher	1	Editing for video tape
VP-13	Time Base Corrector (S/N ratio 57 dB)	2	Editing for video tape
VP-14	Video Typewriter (Character size 4, Color 512)	1	Production for insert character
VP-15	Telop System	1	Editing for insert character
VP-16	CRT (14 in. color)	3	Display for editing
VP-17	Waveform Monitor	1	Editing for video tape
VP-18	Vector Scope	1	Editing for video tape
VP-19	Audio Mixer	1	Editing of effective audio sound
VP-20	Audio Cassette Desk	1	Recording of audio sound
VP-21	Compac Disc Player	1	Playing of audio sound
VP-22	Open Reel Tape Deck	1	Production of Master tape
VP-23	Power Amplifier (150W x 2)	1	Amplifier for speaker
VP-24	Monitor Speaker (150W)	2	Editing speaker
VP-25	Announce Booth Equipment (Mic., CRT, Speaker)	1	Editing for announce
VP-26	Editing Console/Rack	1	Console box
VP-27	Installation Materials	1	Installation equipment for editing device
VP-28	Master S-VHS VTR (same as VP-10)	1	Dubbing for video tape
VP-29	Time Base Corrector (S/N ratio 57 dB)	1	Dubbing for video tape
VP-30	Video Distributor	1	Dubbing for video tape
VP-31	Audio Distributor	1	Dubbing for video tape

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
VP-32	Slave S-VHS VTR	5	Dubbing for video tape
VP-33	Dubbing Controller	1	Dubbing for video tape
VP-34	Monitor Selector	1	Dubbing for video tape
VP-35	CRT (14 in. color)	2	Dubbing for video tape
VP-36	Dubbing Rack	2	Dubbing for video tape
VP-37	Installation Materials	1	Installation equipment for dubbing device
VP-38	S-VHS Video Tape (60 min.)	130	Video tape for text
VP-39	Audio Cassette Tape (60 min.)	90	Video tape for text
VP-40	Audio Open Reel tape (7 in.)	50	Video tape for text

19. AUDITORIUM

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
AT-01	Motor-Drive Main Screen (120 inch)	1	Screen for video projector
AT-02	Lecture Table	1	Lecture table
AT-03	Main Speaker (250W)	2	For lecture
AT-04	Dynamic Microphone (50-15,000Hz)	6	For lecture
AT-05	Wireless Microphone (20-12,000Hz)	6	For lecture
AT-06	Video Projector (Horizontal resolution 1000 lines)	1	Projection of video tape for text
AT-07	Visual Presenter (340x250mm, 25W)	1	Projection for text
AT-08	Wireless Antenna	2	For wireless microphone
AT-09	Video Rack (VTR, CRT, Rack)	1	Video equipment & rack
AT-10	Audio Rack (Mixer Cassette deck, Amp., Rack)	1	Audio equipment & rack
AT-11	Ceiling Speaker	6	For projection video
AT-12	Installation Materials	1	Installation equipment

20. AUDIO/VISUAL ROOM

No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
AV-01	Motor-Drive Main Screen (100 inch)	1	Screen for video projector
AV-02	Video Projector (Horizontal resolution 1000 lines)	1	Projection of video tape
AV-03	Main Speaker (250W)	2	For video projection
AV-04	AV Rack (VTR, CRT, Rack)	1	AV equipment & rack
AV-05	Installation Materials	1	Installation equipment

21. TEXT PRINTING ROOM			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
TP-01	Super Digital Duplicator (A3, 400 dpi, 60-130 sheets/min., 0.75KW)	2	Printing of document, text, examination paper
TP-02	Bookbinding Machine (300x400x300mm)	1	Bookbinding for text
TP-03	Word Processor (16bit 1MB RAM)	1	Making for document and text
TP-04	Laser Printer (240dpi)	1	Print out document and text
TP-05	Copying Machine (A3, 50-200%, 35 sheets/min•A4)	1	Copying of document, text, examination paper
TP-06	Accessories and Consumables	1	

22. LANGUAGE LABORATORY ROOM			
No.	DESCRIPTION (SPECIFICATION)	QTY	PURPOSE OF USE
LL-01	Master Section [teacher] (Tape recorder, CRT 14", Head set)	1	Operation desk for teacher
LL-02	Booth Section [student] (Tape recorder, Head set)	20	Operation desk for student
LL-03	Installation Materials	1	Installation for equipment
LL-04	Motor-Drive Main Screen (100 inch)	1	Screen for video tape
LL-05	Video Projector (Horizontal resolution 1000 lines)	1	Projection of video tape
LL-06	Main Speaker (160W)	2	For video projection
LL-07	AV Rack (VTR, CRT 14", Rack)	1	AV equipment & rack
LL-08	Installation Materials	1	Installation equipment

4.3.2 Layout Plan of Equipment

(1) Coordination With Construction Plan

The PTC building currently under construction was originally designed on the premise that it would house the equipment provided by the Project. The blueprints as well as each supplementary facility is also based on this premise. During the discussions and survey of the basic design study, there appeared to be no significant problem in design. However, installation work on utilities (electricity, water supply/sewerage, etc.), making and installing desks, shelves, and other furniture by the Thai side greatly affect the use and installation of equipment. Therefore, detailed discussions will be made with the relevant Thai authorities in the detailed design stage..

The following concrete measures will be taken to coordinate the Project with construction plans:

- 1) The number, capacity, and location of plug receptacles for each room will be checked against the electricity requirements of each unit of equipment.
- 2) The outlet location of wiring in rooms requiring concealed wiring with double floors (personal computer training room, CAD) will be checked.
- 3) Rooms requiring air conditioning and ventilation will be checked and the grade will be set.
- 4) Foundation work of heavy equipment (CNC machine) will be checked.
- 5) Rooms requiring water supply/sewerage piping and the required capacity will be reconfirmed.
- 6) Power wiring plans of the first floor (CNC Machining Workshop) will be checked.
- 7) Timing and methods of delivery and installation will be coordinated.
- 8) Purchasing and layout plan of furniture including desks, racks, etc will be checked.

(2) Important Points of the Layout Plan

The layout plan should be carried out based on the following important points:

- 1) Heavy equipment or equipment which vibrate or produce noise will be located on the first floor in order to lessen the effect on the other rooms.
- 2) Labs which are related in content will be placed on the same floor as much as possible, in order to increase effectiveness of lecture and equipment use.
- 3) Labs which will be shared by different courses will be placed on the same floor or in near proximity to each other..
- 4) Rooms where there is a constant flow of people or which require equipment to be frequently carried in or out will be placed on the lower floors.

The layout plan of equipment based on an evaluation of the aforementioned points is shown in Appendix 2.11.

(3) Layout Plan of Room

Based on the evaluation of aforementioned points and deliberations with PTC authorities, the layout of labs, etc. was decided as shown below.

Story	Name of Room	Abbr.
1st. Floor	Text Printing Room CNC Machining Workshop Metrology Room (Machine & Electricity Room) (Office & Staff Room)	TP CNC MET
2nd. Floor	Language Laboratory Audio/Visual Room Auditorium Video Production Studio (Art Work Room)	LL AV AT VP
3rd. Floor	Computer-Aided Design Laboratory Microcomputer Laboratory Digital Electronics and Microprocessor Laboratory Personal Computer Laboratory(1) (2) (Staff Room) (Store Room)	CAD ML DML PCL
4th Floor	Industrial Instrumentation Laboratory Computer Aided Measurement Laboratory Electronic Device and Circuit Laboratory Instrumentation Laboratory Hydraulics and Pneumatics Laboratory (Electric Circuit Laboratory) (Staff Room) (Store Room)	IIL CML ECL IL HPL
5th Floor	Process Control Laboratory Industrial Electronics Laboratory Automatic Control Laboratory Power Electronics and Electric Drive Laboratory Transducer Laboratory (Staff Room) (Store Room)	PRO IEL AL PEL TL
6th Floor	Telecommunication Laboratory (Social Room)	TEL

NOTE: Rooms indicated in the parenthesis will be transferred from existing PTC buildings.

1) First Floor

The CNC machining workshop and printing room for educational materials will be placed on the first floor since the CNC machining workshop needs foundation work and the printing room requires frequent delivery and pick up of materials. In order to alleviate the vibration and noise produced from the machinery, the air compressor will be installed in the electric and machine room.

2) Second Floor

The video production room, LL room, Auditorium, audio-visual room, etc. requiring the use of audio visual equipment will be concentrated on the second floor, taking into consideration the large number of people who are expected to utilize these rooms.

3) Third, Fourth, and Fifth Floors

Rooms are placed according to equipment correlation and convenient of liaison between departments.

4) Sixth Floor

The telecommunication lab is placed on the sixth floor for convenient installation of antennas and related wiring included in Thai future plan.

4.4 Implementation Plan

4.4.1 Implementation Method

Activities related to both Project implementation and construction implementation of the new PTC building are under the supervision of DOVE. After an official Exchange of Notes has been completed between the Governments of Thailand and Japan, the Japanese consultant company which will sign the contract with the Government of Thailand will carry out detailed design and supervision of the Project. The Japanese companies selected by tender will supply the equipment and carry out its installation.

In consideration of the fact that the Project will be carried out under the auspices of a grant aid by the Government of Japan, the following points significant to Project implementation are outlined below.

- (1) Project will be implemented considering the coordination between construction work by the Thai side and equipment installation plans.
- (2) Electrical, water supply/sewerage piping and air piping work will be clearly allocated to ensure smooth and effective installation work.
- (3) A clear working relationship based on thorough discussions among the Thai officials, Japanese consultants, and equipment suppliers will be established.
- (4) Utmost care will be taken in temporary storage, transport and installation of equipment to avoid equipment damage.

4.4.2 Supervisory Plan

Thorough consultations with Thai authorities in charge will be carried out and the supervisory plan will be formulated. Based on this plan, the Japanese consultant company will dispatch their staff to the Project site at appropriate times to ensure effective Project implementation.

The following important items should be taken into consideration.

- (1) In order to guarantee trouble free delivery and installation of equipment, close consultations will be made with Thai authorities from the stage of detailed design. Particular attention will be paid to construction work carried out by the Thai side in order to satisfy conditions required for equipment installation. Progress of construction work undertaken by the Thai side will always be checked; and the construction work will be coordinated to ensure the work is completed before the equipment is delivered to the Project site.
- (2) The equipment suppliers will be required to submit their installation plans before equipment is delivered. The content of these plans will be thoroughly examined to check the suitability of manufacturing, delivery schedule and equipment specifications.
- (3) Equipment will be inspected in Japan prior to shipment to ensure that specifications, content, quantity, etc. satisfy Project design requirements.
- (4) Before the equipment is delivered and turned over to the Thai side, it will be ascertained whether location and installation of equipment is appropriate, and whether proper instruction has been given to the Thai side on equipment use, operation and maintenance.
- (5) In order to guarantee trouble free installation, close communication based on thorough discussions will be maintained among relevant Thai authorities, consultants, and equipment suppliers.

4.4.3 Procurement Plan of Equipment

Basically, equipment of this Project is to be procured in Japan. However, following equipment is likely to be procured locally or in a third nation.

(1) Computer and related software

Manufacturers of popular computer in Thai industry/educational field have an agent or assembly plant in Thailand and there will be no problem in terms of after-sales services. Moreover, PTC is presently using the same popular computer and coordination with the existing PTC computer should be taken into consideration in selecting equipment of this

Project: In addition, Thai language should be applicable to the computer planned. Therefore, computer will be procured locally.

(2) Equipment for Hydraulics & Pneumatics Laboratory

Training units are likely to be procured from a third nation taking into consideration the coordination with the existing equipment which is the product of England.

4.4.4 Undertakings by Both Governments

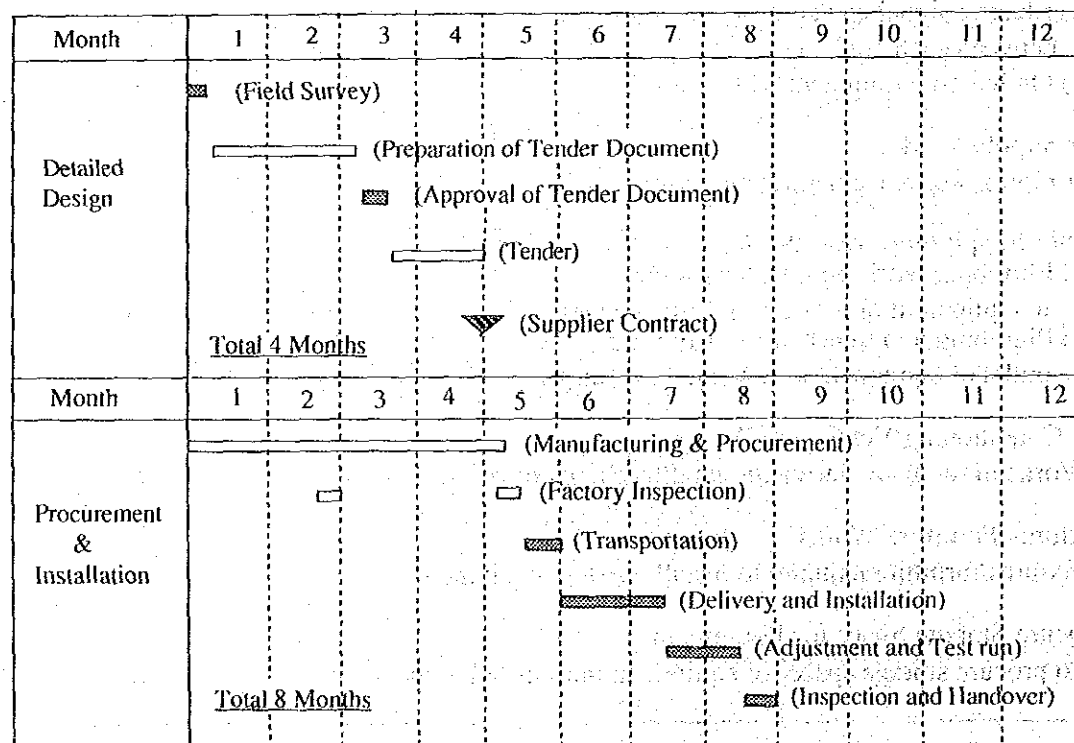
Undertakings of both Governments for the Project are shown in the following table.

Undertakings of the Works		
content	Japan	Thailand
(1) Equipment		
1) Procurement	○	
2) Installation	○	
3) Testing	○	
4) On site instruction/training	○	
(2) Electrical Works		
1) Primary electric wiring works by the electric power distribution panel and control/terminal plate		○
2) Electric signal and control wiring works between each equipment	○	
3) Outlets for equipment with plugs		○
(3) Air Supply Works		
Air piping works from air compressor		○
(4) Water Supply/Sewerage Works		
1) Plumbing work from water source to equipment or rooms requiring a water		○
2) Plumbing and trench work from drain outlet of equipment to sewerage facilities		○
(5) Air Conditioning/Ventilation Works		
Works in rooms requiring air conditioning/ventilation		○
(6) Fixtures/Furniture Works		
Fixtures/furniture required to install or store equipment		○
(7) Procure Storage Space for Equipment		
To procure storage space for equipment until installation		○

content	Japan	Thailand
(8) Import/ Customs Procedures		
1) Transport to Thailand	○	
2) Customs/duty free procedures for imported equipment		○
3) Domestic transport in Thailand		
Transport of equipment from unloading port to PTC	○	
(9) Payment of B/A handling charges for Japanese exchange bank		○
(10) Immigration procedures in Thailand for Japanese personnel relevant to Project		○
(11) Appropriate operation and maintenance of grant aid equipment		○
(12) Construction of facilities, transport, installation costs of equipment not included in grant aid		○
(13) Procurement of approval, etc. required for Project implementation		○

4.4.5 Implementation Schedule

The implementation schedule of the Project is shown below.



4.4.6 Project Cost Undertaken by the Government of Thailand

The total construction cost of the PTC building is estimated at 49 million bahts. Of this amount, 32 million bahts has been spent on construction to date. An additional 3 million bahts due to the skyrocketing costs of materials and 14 million bahts for installation of air-conditioning/ventilation facilities and purchasing of desks and racks etc. are under the request.

5. EVALUATION OF THE PROJECT AND CONCLUSION

5. EVALUATION OF THE PROJECT AND CONCLUSION

5.1 Effects of Project Implementation

5.1.1 Effects and Impact on PTC and Vocational Education

The Pathumwan Technical College is the central and foremost technical college in Thailand. Currently, the institution has ten departments and a student body of approximately 1,600 students. Its graduates are technicians, engineers, and future faculty instructors of technical colleges. The college plays a significant role in technical vocational education. However, training equipment necessary for basic knowledge and practical application in mechatronics and electronics, which enable the institution to keep up with the high technological standards of the industrial sector, is lacking. As a result, comprehensive educational programs cannot be carried out.

The equipment to be provided in the Project is expected to complete the educational and training programs in the labs and to upgrade the student level and educational content of the college. Consequently, the Project will enable PTC to foster highly skilled graduates who are able to immediately participate in the industrial sector as qualified engineers and technicians.

Furthermore, in addition to increasing the student body to 2,200 students in 1993 and to 2,420 in 1996, PTC also has plans to institute re-education programs for instructors of other technical colleges, in order to update their knowledge on new technology. When the new building is completed and Project equipment has been provided, such future plans will become possible to implement; and it is anticipated that not only PTC, but the content of vocational education in general will improve.

5.1.2 Effects on the Society of Thailand

In recent years the industrial sector of Thailand has developed at a formidable rate. Consequently, the demand for qualified, highly skilled engineers and technicians in high tech fields who are immediately useful upon graduation, is high. Unfortunately, technical education in Thailand has been unable to meet this demand, due to the insufficient content of its technical education programs.

Implementation of this Project will allow PTC and other technical colleges to produce skilled technicians and engineers to meet the needs of the industries. Not only does the Project support the national policies of Thailand to upgrade education in science and technology and to produce a skilled labor market, but it also contributes to continuous economic development.

5.2 Conclusion and Recommendation

5.2.1 Conclusion

The shortage of highly skilled technicians and engineers in the industrial sector of Thailand is a serious problem for the nation; and it is on the verge of becoming a major obstacle to continuous economic development. Under these circumstances, this Project which aims to improve the technical educational content of PTC and other technical colleges, meet the current needs of the industrial sector; and it is expected to greatly contribute to resolving the shortage in qualified technical personnel.

In addition, the Project supports the objectives of the Seventh National Economic and Social Development Plan; and it is anticipated to contribute to the nation's economic growth, to the promotion of its industries, and to improved educational programs in science and technology. Therefore, it has been concluded that the Project is meaningful and appropriate to be implemented under the auspices of the grant aid program of the Government of Japan.

5.2.2 Recommendation

(1) Recommendation for Measures to be Taken by the Government of Thailand

The Project will be implemented with the cooperation and endeavor of both Thailand and Japan. In order to ensure trouble free and effective Project implementation and operation, the Government of Thailand will take the following measures:

- 1) The Government of Thailand will endeavor to see that construction of the new building progresses on schedule, in order to avoid delays in equipment delivery and installation.
- 2) In order to effectively utilize equipment to be provided in the Project, it is necessary to carry out thorough operation and maintenance.
- 3) It is desirable that measures be taken to secure a budget that will adequately cover operation and maintenance expenses.

(2) Recommendation on Technical Cooperation

The equipment provided by the Project was selected on such criteria as PTC educational levels, curriculum, plans on design and construction of the new building, etc.; and only equipment which will be effectively operated and maintained by the Thai side was selected. Although use of the equipment is expected to improve PTC educational levels, it is

desirable that Japanese technical cooperation such as dispatching Japanese experts in related fields to Thailand, teachers training in Japan, etc. be included to further enhance effective use of equipment.

APPENDIX

APPENDIX

Appendix 1

1.1 Members of Study Team-----	87
1.2 Itinerary -----	88
1.3 List of Members Contacted -----	90
1.4 Minutes of Discussions -----	92

Appendix 2

2.1 Economic Index-----	101
2.2 Transition of Export Constitution-----	101
2.3 Transition of Direct Investment into Thai Industrial Sector-----	102
2.4 Structure of Ministry of Education-----	103
2.5 Curricula of Diploma Level -----	104
2.6 The Number of Students Planned by PTC (1991-1996)-----	108
2.7 Other Institutes for Vocational Education -----	110
2.8 Laboratory Schedule by Each Course per Week -----	113
2.9 Laboratory Schedule by Subjects per Week (Diploma Level)---	114
2.10 Laboratory Schedule by Subjects per Week (Higher Diploma Level) -----	117
2.11 Layout Plan -----	119
2.12 Abbreviations of Laboratory/Other Room Names-----	125
2.13 Mechanical & Electrical Works by Thai Side -----	126

APPENDIX - 1

Appendix 1.1 Members of Study Team

1) Basic Design Study Team

Name	Speciality	Present Position
Katsumi ISHIHARA	Team Leader	Professor of Applied Physics Dept. of Mechanical Engineering, Gifu National College of Technology
Masazumi KUMAGAI	Engineering Education	Professor, Dept. of Electronic Engineering, Sendai National College of Technology
Akihiro MATSUMOTO	Project Coordinator	Second Basic Design Study Division, Grant Aid Study and Design Department, JICA
Teruo YABANA	Equipment Planner	System Science Consultants, Inc.
Hideo SUZUKI	Equipment I (Electronics)	System Science Consultants, Inc.
Hiroshi HARAKAWA	Equipment II (Production Industry)	System Science Consultants, Inc.
Hiroshi KISHIMOTO	Equipment Layout Planner	System Science Consultants, Inc.

2) Draft Final Report Team

Name	Speciality	Present Position
Masazumi KUMAGAI	Team Leader	Professor, Dept. of Electronic Engineering, Sendai National College of Technology
Shoji MATSUMOTO	Project Coordinator	Second Basic Design Study Division, Grant Aid Study and Design Department, JICA
Teruo YABANA	Equipment Planner	System Science Consultants, Inc.
Hiroshi KISHIMOTO	Equipment Layout Planner	System Science Consultants, Inc.

Appendix 1.2 Itinerary

1) Basic Design Study

No.	Date	Itinerary	Activities
1.	Mar.11(Mon)	Narita to Bangkok	* Leaving Japan All members * Arrival in Bangkok
2.	12(Tue)	Bangkok	* Meeting with Japanese Embassy and JICA office * Courtesy call to DTEC, DOVE and PTC * Meeting with DOVE and PTC on explanation and discussion of Inception Report and Questionnaire
3.	13(Wed)	Bangkok	* Site reconnaissance at PTC * Discussion of the Project and sectoral meeting on equipment
4.	14(Thu)	Bangkok	* Site reconnaissance at RIT North Campus * Site reconnaissance at KMITL
5.	15(Fri)	Bangkok	* Site reconnaissance at relevant private firms (Thai CRT, Thai SHINMEIWA)
6.	16(Sat)	Bangkok	* Site reconnaissance at Minburi Technical College and Samutprakan Technical College
7.	17(Sun)	Bangkok	* Analysis of data collected, the results of discussion and site reconnaissance and study
8.	18(Mon)	Bangkok	* Discussion of the Project and sectoral meeting on equipment * Preparation and discussion of the Draft Minutes
9.	19(Tue)	Bangkok	* Signing the Minutes (DOVE) * Reporting to Japanese Embassy and JICA office * Site reconnaissance at KMITN
10.	20(Wed)	Bangkok to Narita	* Leaving Bangkok (Ishihara, Kumagai, Matsumoto)
*Activities to be continued by Yabana, Suzuki, Harakawa and Kishimoto are as follows:			
		Bangkok	* Discussion of the Project and sectoral meeting on equipment
11.	21(Thu)	Bangkok	* Data collection at the Chamber of Commerce and Industry of Japan (Yabana, Kishimoto) * Sectoral meeting on the details/quantity of the equipment (Yabana, Kishimoto) * Site reconnaissance at private firms (Suzuki, Harakawa) * Meeting with DOVE officer in charge of construction of new school building (Kishimoto) * Meeting with Japanese Expert of KMITL
12.	22(Fri)	Bangkok	* Sectoral meeting on the details/quantity of the equipment * Site reconnaissance at private firms (Suzuki, Harakawa) * Meeting with DOVE officer in charge of construction of new school building
13.	23(Sat)	Bangkok	* Readjustment of the data collected and the results of discussion and study
14.	24(Sun)	Bangkok	* Readjustment of the data collected and the results of discussion and study
15.	25(Mon)	Bangkok	* Discussion of the details/quantity of equipment, installation and operation and maintenance (Harakawa, Kishimoto) * Site reconnaissance at private firms (Yabana, Suzuki)
16.	26(Tue)	Bangkok	* Discussion of the details/quantity of equipment, installation and operation and maintenance * Site reconnaissance at private firms (Suzuki)

No.	Date.	Itinerary	Activities
17.	27(Wed)	Bangkok	* Discussion with PTC * Meeting with RIT and OPEC (Yabana)
18.	28(Thu)	Bangkok	* Discussion and preparation of the draft equipment list
19.	29(Fri)	Bangkok	* Meeting with DOVE and PTC on the results of the survey * Reporting to Japanese Embassy and JICA office
20.	30(Sat)	Bangkok to Narita	* Leaving Bangkok

2) Draft Final Report Explanation

No.	Date.	Itinerary	Activities
1.	June 12(Wed)	Narita to Bangkok	* Leaving Japan All members * Arrival in Bangkok
2.	13(Thu)	Bangkok	* Meeting with Japanese Embassy, JICA office * Courtesy call to DTEC, DOVE and PTC * Explanation of the Draft Report
3.	14(Fri)	Bangkok	* Meeting and discussion with & PTC
4.	15(Sat)	Bangkok	* Meeting and discussion with & PTC
5.	16(Sun)	Bangkok	* Team member's meeting
6.	17(Mon)	Bangkok	* Meeting with DOVE on the Minutes * Meeting with Mr. Orihara, first Secretary, Embassy of Japan * Site reconnaissance at TV factory (TANIN-UNION)
7.	18(Tue)	Bangkok	* Signing the Minutes * Reporting to Japanese Embassy, JICA office
8.	19(Wed)	Bangkok to Narita	* Leaving Bangkok (Kumagai, Matsumoto)
* Activities to be continued by Yabana and Kishimoto are as follows:			
8.	19(Wed)	Bangkok	* Supplementary study and discussion with PTC
9.	20(Thu)	Bangkok	* Supplementary study and discussion with PTC
10.	21(Fri)	Bangkok to Narita	* Leaving Bangkok

Appendix 1.3 List of Members Contacted

Organization & Position	Name
<u>Embassy of Japan</u>	
First Secretary	Mr. Yoshihiko Kamo
First Secretary	Mr. Takanori Kawashima
First Secretary	Mr. Mamoru Orihara
<u>JICA Thailand office</u>	
Resident Representative	Mr. Nobuji Abe
Asst. Resident Representative	Mr. Makoto Ashino
Manager	Mr. Athorn Charoenlai
<u>Dept. of Vocational Education, Ministry of Education (DOVE)</u>	
Director General	Mr. Boontiam Chareonying
Deputy Director General	Mr. Khien Suwannasing
Deputy Director General	Ms. Srinuan Komolavanji
Deputy Director General	Mr. Artorn Chandavimol
Director, Planning Division	Mr. Prasert Nonpala
Director, Technical College	Mr. Amnaj Sawatdiwong
Chief External Coop. Program, Planning Division	Ms. Chavee Boonkoom
External Relations Section, Planning Division	Mr. Aminat Boonsirivibul
Technical College Division	Ms. Sasiporn Dojjanavaroe
<u>Dept. of Technical and Economic Cooperation, The Prime Minister's Office (DTEC)</u>	
Director, External Cooperation, Division 3	Mr. Apinan Pattiyanonda
Chief, Japanese Sub-Division	Ms. Tipsuda Nopmongcol
JICA Expert, Technical Cooperation Coordination	Mr. Tomikazu Inagaki
<u>Pathumwan Technical College</u>	
Director	Mr. Sa-Nguan Boonpiyathud
Asst. Director, Educational Promotion	Mr. Sutep Hunsawat
Asst. Director, Academic Affairs	Mr. Vachara Anusasanakul
Head of Faculty, Basic Subject	Ms. Saisawat Amatyakul
Head of Faculty, Metal Technology	Mr. Chaover Somalad
Teacher of Higher Diploma Level	Dr. Warin Suiranwisoot
Head of Dept., Production Technology	Mr. Manys Sriwong
Head of Dept., Mechatronics	Mr. Suthep Buddee
Head of Dept., Instrumentation and Process Control	Mr. Tanapat Boonpanias
Head of Dept., Industrial Electronics	Mr. Silchai Wuthanusorn
Head of Dept., AV Aid Unit	Mr. Manop Chulawong
Head of Dept., Basic Technology	Mr. Chanint Mumsiri
Instructor, Instrumentation	Mr. Arkom Maneekanto
Instructor, Electronics	Mr. Prapoj Jirasakulporn
Head of Machine Shop	Mr. Chalermchal Rungruanakikral
Head of Unit, Typing & Duplicating	Mr. Somjai Chareonpinit
<u>Samutprakan Technical College</u>	
Director	Mr. Boonchu Moonpinit
Asst. Director	Mr. Surasak Srinoi

Rajamangala Institute of Technology (RIT)

President of RIT
Head of Electrical Dept.,
North Bangkok Campus

Mr. Tamnoon Ridditmani
Mr. Mancee Gaownane

King Mongkut's Institute of Technology North Bangkok Campus (KMITN)

Associate Director, College of
Industrial Technology

Mr. Wanchai Chantawong

King Mongkut's Institute of Technology, Ladkrabang Campus (KMITL)

President
JICA Expert, Telecommunication
JICA Expert, Telecommunication
JICA Expert, Mechanical Eng.
JICA Expert, Project Coordination

Mr. Kosol Petchswan
Mr. Kanar Hiraguri
Mr. Mutsuo Hirasato
Mr. Toshio Iijima
Mr. Hideo Sakuraba

Office of the Private Education Commission (OPEC)

Secretary General, OPEC
Director, Private Vocational School Division
Director, Policy and Planning Division

Mr. Charan Padmadilok
Mr. Chamras Sudanich
Mr. Sen Keoyote

Appendix 1.4 Minutes of Discussions

1) Basic Design Study MINUTES OF DISCUSSION

THE BASIC DESIGN STUDY

ON

THE PROJECT FOR PROVIDING THE EQUIPMENT FOR PATHUMWAN TECHNICAL COLLEGE IN THE KINGDOM OF THAILAND

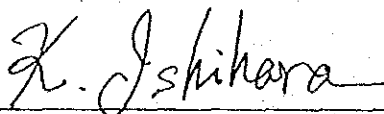
In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a Basic Design Study on the Project providing the equipment to develop courses in High Production and Industrial Technology at Pathumwan Technical College (hereinafter referred to as "the Project"), and entrusted the study to Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA has sent to Thailand the Study Team headed by Dr. Katsumi ISHIHARA, Professor, Department of Mechanical Engineering, Gifu National College of Technology, from March 11 to March 30, 1991.

The Team has carried out a field survey, held a series of discussions and exchanged views with the officials concerned of the Government of the Kingdom of Thailand.

As a result of the discussion and field survey, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined toward the realization of the project.

March 19, 1991



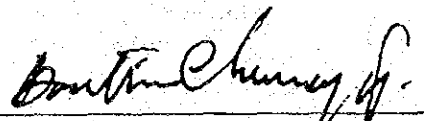
Dr. Katsumi ISHIHARA

Leader

Basic Design Study Team

Japan International

Cooperation Agency (JICA)



Mr. Boontiam CHAREONYING

Director-General

Department of Vocational

Education (DOVE)

Ministry of Education

ATTACHMENT

1. Title of the Project

The title of the Project is "The Project for providing the Equipment for Pathumwan Technical College".

2. Objectives of the Project

The objectives of the Project are to contribute to developing the industrial field in Thailand through providing the equipment to Pathumwan Technical College (PTC) and to foster qualified and competent graduates to cope with modern technology.

3. Implementing Agency

The responsible and implementing agency for the Project is Department of Vocational Education (DOVE), Ministry of Education.

The Recipient Institute under DOVE is Pathumwan Technical College, who under the jurisdiction of DOVE shall be accountable and responsible for operation and maintenance of the Equipment.

4. Project Site

The Project site is located in the new building at the campus of Pathumwan Technical College in Bangkok.

5. Summary of Request by the Government of the Kingdom of Thailand

The summary of the requested equipment is shown in the attached ANNEX-I.

6. Japanese Grant Aid programme

The Thai side has understood Japan's Grant Aid system explained by the Team which includes a principle for use of a Japanese consulting firm and a Japanese supplier for implementation of the Project.

H.I

Bout

7. Necessary Measures to be taken by Thai side

The Government of the Kingdom of Thailand will take necessary measures listed in ANNEX II on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

8. Training in Japan

The Thai side strongly requested further training of PTC instructors in Japan.

K.I

Baut.

ANNEX I

The fields and major items requested by the Government of the Kingdom of Thailand are the followings:

1. Equipment for Mechatronics Course Priority A
 - 1.1 CNC Electric Wire-Cut Discharge Machine
 - 1.2 CNC Vertical Machining Center
 - 1.3 CNC Lathe Machine
 - 1.4 CAD/CAM Training Computer and Software
 - 1.5 Small Scale Flexible Manufacturing System
 - 1.6 Coordinate Measuring Machine
 - 1.7 Other Measuring Devices and Tools
2. Equipment for Industrial Electronics Course Priority A
 - 2.1 Educational Robot System
 - 2.2 Optical Fiber Training Set
 - 2.3 Personal Computer
 - 2.4 Microcomputer Module
 - 2.5 Other Measuring Devices
3. Equipment for Instrumentation and Process Control Priority A
 - 3.1 Logic Trainer
 - 3.2 Electronic Circuit Trainer
 - 3.3 Personal Computer
 - 3.4 Microcomputer Module
 - 3.5 Other Measuring Devices
4. Equipment for Video Program Production and Display Priority B
 - 4.1 Equipment for Video Production
 - Camera System
 - Audio System
 - Editing System
 - Lighting System
 - 4.2 Equipment for Audio/Visual Laboratory Auditorium
 - Video Projector System
 - VTR System
 - Audio System

Handwritten signature/initials

Handwritten signature/initials

5. Equipment for Text Printing

Priority B

5.1 Automatic Multi-Graph

5.2 Binding Machine

6. Equipment for Language Learning System

Priority C

6.1 Console System

6.2 Master Tape Recorder

6.3 Room Speaker

6.4 Head set

K.I

Bout.

Necessary Measures to be taken by Thai side

1. To complete the construction work of the new building in which the equipment will be installed in a timely manner.
2. To provide facilities for distribution of electricity, water supply, drainage and other incidental facilities and furniture which are required for installation of the equipment before the commencement of installation works.
3. To ensure prompt unloading, tax exemption and customs clearance of the products purchased under the Grant Aid at port of disembarkation in Thailand.
4. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levy which may be imposed in Thailand with respect to the supply of the products and services under the verified contract.
5. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Thailand and stay therein for the performance of their works.
6. To ensure the necessary budget and personnel for the proper and effective operation and maintenance of the Equipment to be procured under the Grant Aid.
7. To provide necessary permissions, licenses and other authorizations to carry out the Project.
8. To bear two kinds of commissions to the Japanese foreign exchange bank for the banking services, based upon the "Banking Arrangement", namely, the advising commission of the "Authorization to Pay" and payment commission.
9. To bear all the expenses, other than those to be borne by the Grant Aid.

H. J

Bout

2) Draft Final Report Explanation

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY ON THE PROJECT FOR PROVIDING THE EQUIPMENT FOR

PATHUMWAN TECHNICAL COLLEGE IN

THE KINGDOM OF THAILAND

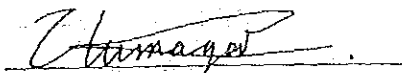
(CONSULTATION ON DRAFT REPORT)

In March 1991, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Providing the Equipment for Pathumwan Technical College (hereinafter referred to as "the Project") to the Kingdom of Thailand, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Thai side on the components of the draft report, JICA sent to Thailand a study team, which is headed by Dr. Masazumi KUMAGAI, Professor, Department of Electronic Engineering, Sendai National College of Technology, and is scheduled to stay in the country from June 12 to 21, 1991.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Bangkok, June 18, 1991



Dr. Masazumi KUMAGAI

Leader

Draft Report Explanation Team

JICA



Mr. Boontiam CHAREONYING

Director General

Department of Vocational

Education (DOVE),

Ministry of Education

ATTACHMENT

1. Components of Draft Report

The Thai side agreed in principle to the basic design proposed in the Draft Final Report.

2. Japan's Grant Aid System

(1) The Thai side has understood the system and principle of the Japanese Grant Aid Program.

(2) The Government of Thailand reconfirmed the necessary measures for the realization of the Project which are manifested in the "Minutes of Discussions" on the Project signed on March 19, 1991.

3. Further schedule

The team will make the Final Report in accordance with the confirmed items, and send it to the Government of Thailand by the end of September 1991.

M. Ku. *Bantra Sheng* -99-

APPENDIX - 2

Appendix 2.1 Economic Index

Item	1986	1987	1988	1989
GDP				
Nominal (Billion Bahts)	1,095.4	1,253.1	1,507.0	1,790.8
(Billion Dollars)	41.7	48.7	59.6	70.0
Real Growth Rate (%)	4.9	9.5	13.2	12.2
GNP per Capita				
Thailand(\$)	776.0	893.0	1,076.0	1,255.0
(Bangkok)	2,336.0	2,784.0	-	-
(Northeast Thailand)	300.0	325.0	-	-
Industrial Composition (%)				
Agriculture, Forestry and Fisheries	-	16.4	16.6	15.1
Mining	-	3.1	3.2	3.5
Manufacture	23.6	23.9	24.8	25.4
Service	57.0	56.6	54.4	56.0
Price Increase Rate (%)				
Consumer price	1.9	2.5	3.8	5.4
Unemployment rate	9.1	6.7	6.4	5.6
Population (million people)	56.25	53.61	54.54	55.50

Source: Statistical Year Book, 1989

Appendix 2.2 Transition of Export Constitution

Unit: million baht, Share: % (growth rate)

	1980	1985	1986	1987	1988	1989
Primary Products	83,543	94,479	101,153	108,092	135,703	155,755
Agricultural Products	62,506	73,398	79,397	83,259	106,432	118,572
Fisheries Products	5,547	10,590	14,853	18,163	20,826	28,538
Forest Products	70	365	620	819	814	703
Mining Products	15,420	10,126	6,283	5,851	7,631	7,962
Industrial Products	43,065	95,615	129,170	188,031	263,737	353,658
Total Export Amount	133,197	193,366	233,383	299,853	403,570	515,754
Share of Primary Products	62.7	48.9	43.3	36	33.6	30.2
Share of Agricultural Products	46.9	37.9	34.0	27.8	26.4	22.9
Share of Industrial Products	32.3	49.4	55.3	62.7	65.4	68.6
Growth Rate of Primary Products	-	13.1	7.1	6.9	25.5	14.8
Growth Rate of Industrial Products	-	122.0	35.1	45.6	40.3	34.1

Remark: The growth rate in 1985 is based on the figure in 1980.

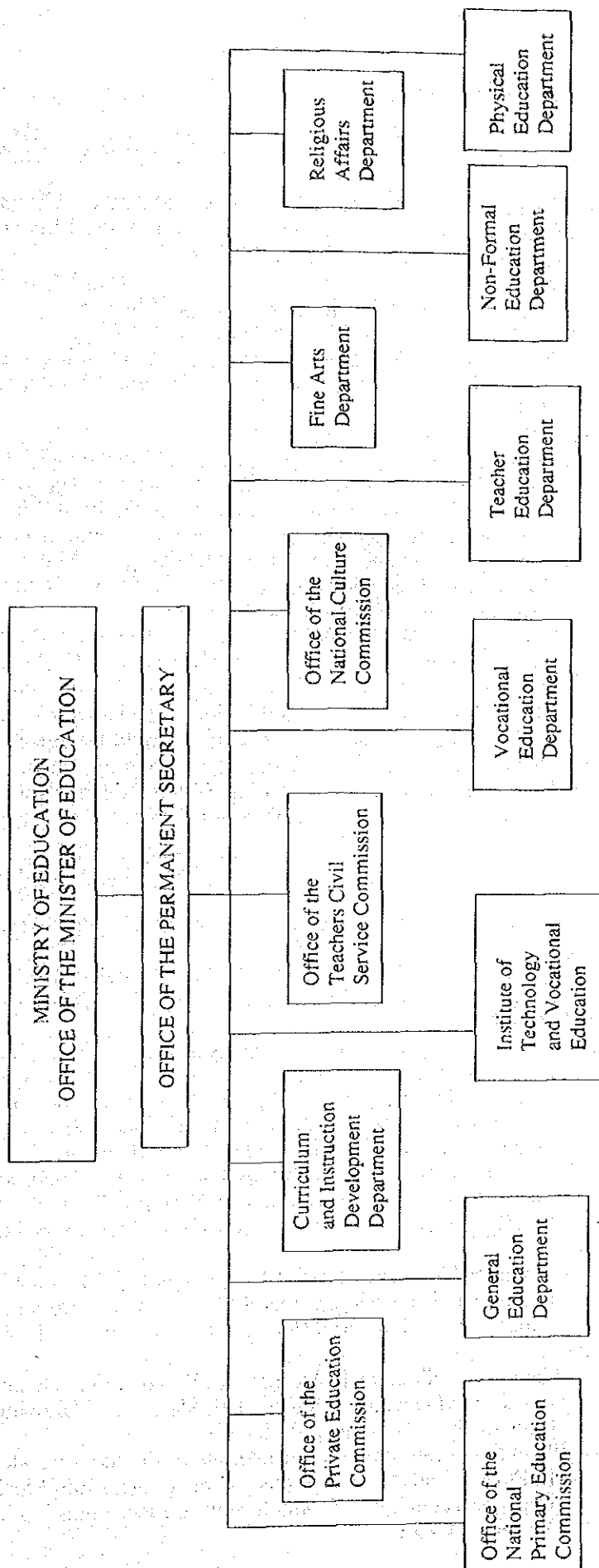
Source: Bank of Bangkok

Appendix 2.3 Transition of Direct Investment into Thai Industrial Sector

Unit: million baht

Category	Year	1985	1986	1987	1988	1989
Food		394.8	286.9	436.6	1,229.5	1,949.6
Textiles		59.9	85.7	995.7	1,119.5	686.4
Meat/Nonmetal Products		-125.7	-22.6	365.1	1,960.1	2,510.0
Electric Products/Parts		280.0	617.0	1,136.5	6,309.2	8,497.2
Machinery/Vehicle		32.0	-14.9	159.9	727.2	714.9
Chemical Products		488.4	484.0	868.1	1,947.0	2,524.8
Petroleum Products		0.0	8.2	-15.8	833.6	-1,189.6
Construction Materials		38.3	5.4	6.3	26.8	85.4
Others		190.4	674.1	796.8	2,192.1	4,622.4
Total		1,358.1	2,123.8	4,749.2	16,345.0	20,401.1

Source: Bank of Bangkok



Appendix 2.4 Structure of Ministry of Education

Appendix 2.5 Curricula of Diploma Level

Production Technology

Related Subjects (23 credits) - Mathematics I-II, Science I-II, Technical English I-II, Human Relations, Organization & Management, Industrial Economics, Research Procedure & Report Writing

Basic Technological Subjects (21 credits)

- Machine Design, Machine Tools Design, Machine Elements Design, Metallurgy, Plastic Technology, Industrial Plant Management, Automatic Controlling System, Engineering Mechanics I, Strength of Materials I, Pneumatics & Hydraulics

Technological Subjects (34 credits)

Major Machine Tools ----- Machine Elements Practice I, Mechanical Practice I-III, Cutting Tools Making I-II, Fixture Practice, Mechanical Technology, Precision, Material Testing, Cutting Tools Design I, Mechanical Elements & Structure Design I-II, Machine Elements Practice II, Machine Repairs, Mechanical Product Design & Making, Cutting Dies Technology, Pneumatics-Hydraulics-Automatic Controlling System, Mechanical Testing

Major Dies ----- Cutting Tools Making, Machine Repairs, Die Parts Making I, Die Parts Making II, Die Making I, Die Making II, Precision, Material Testing, Cutting Tools Design, Die Design, Injection Mould Design, Die Design & Making I, Die Design & Making II, Die Design & Making III, Injection Mould Design & Making, Cutting Dies Technology, Pressing Technology, Pneumatics-Hydraulics-Automatic Controlling System, Mechanical Testing

Elective(10 credits)

Select out of 26 technological subjects

Industrial Technology

Industrial Technology

Related Subjects (22 credits) - Mathematics I-II, Science I-II, Technical English I-II, Human Relations, Industrial Economics, Organizations & Management,

Basic Technological Subjects(42 credits)

Common Basic Subjects ---- Mechanical Drawing & Print Analysis I, Engineering Mechanics I, Strength of Materials I, Pneumatics & Hydraulics, Machine Elements, Quality Control, Machine Lab I, Machine Lab II, Air Conditioning & Refrigeration, Air Conditioning & Refrigeration Practice, Fuels & Lubricating Oils, Fluid Mechanics, Thermodynamics I-II, Metrology Lab, Industrial Electricity

Specific Basic Subjects ---- Power Plant, Power Plant Practice, Welding Technology, Welding Practice, Mechanics Technology, Mechanics Practice

Technological Subjects(20 credits)

Major Production ----- Machine Tools, Production Management I-II, Machine Tools Design I-II, Tempering, General Plastics Work, Product Design, Punch & Dies, Industrial Practice

Major Installation & Maintenance

----- Plant & Installation I-II, Design I-II, Repairs & Maintenance I-II, Repairs & Maintenance Practice I-II, Mechanical Drawing & Print Analysis II, Industrial Practice

Electives (6 credits)----- Paint Spraying, Strength of Materials II, Engineering Mechanics II, Power Transmission, Industrial materials, Fluid Mechanics, Machine Techniques, Piping System I, Electronics Technology, Machine Design

Automechanics Technology

Related Subjects (22 credits)--Mathematics I-II, Science I-II, Technical English I-II, Organization & Management, Human Relations, Industrial Economics

Basic Technological Subjects(40 credits)

-----Mechanical Drawing & Print Analysis I-II, Fluid Mechanics, Thermodynamics I-II, Fuels & Lubricating Oils, Engine Repairs, Internal Combustion Engine I, Auto Electricity, Machine Installation & Maintenance, Metrology Lab, Industrial Electricity, Engineering Mechanics I, Strength of Materials I, Pneumatics & B Hydraulics, Power Transmission, Quality Control, Industrial Materials, Mechanical Testing I

Technological Subjects(21 credits)

Major Automotive Techniques

-----Transmission & Suspension, Internal Combustion Engine II, Automotive Engineering, Gas Fuels, Pump & Nozzle Testing, Diesel Engine Repairs, Mechanical Testing II (Pneumatics & Hydraulics), Air Conditioning & Refrigeration, Air Conditioning & Refrigeration Practice

Major Power Plant Technique

-----Transmission & Suspension, Air Compressor, Steam Engines, Diesel Engineering, Automotive Engineering, Diesel Engine Repairs, Steam Engine & Boiler, Mechanical Testing II (Pneumatics & Hydraulics), Air Conditioning & Refrigeration, Air Conditioning & Refrigeration Practice

Electives (7 credits) ----- Select out of 21 technological subjects

Electrical Power Technology

Related Subjects (28 credits)--Mathematics, Statistics, Science, Technical English I-II, Human Relations, Organization & Management, Industrial Economics, Research Procedure & Report writing, Strength of Materials I

Basic Technological Subjects(51 credits)

-----Electrical Circuits I, Electrical Drawing, Power Plant, Pneumatics & Hydraulics, Electrical Control, Industrial Electronics I-II, Electrical Installation I, Electrical machines I-II, Air-conditioning & Refrigeration I, Electrical Circuits II, Electrical Repairs & maintenance, Electrical Transmission & Distribution, Electrical Project, Electrical Instruments, Microcomputer & Usage, Industrial Practice, Electrical Mathematic, Electromagnetic Field Theory

Technological Subjects (9 credits)

Major Industrial Instrumentation

-----Pulse & Digital Techniques, Industrial Instrumentation & Process Control I-II,

Major Installation I& Control

-----Electrical Installation II, Illumination, Estimating & Basic Design, Laws & Electrical Standards

Major Electrical machine -- Electrical Machines III, Electrical Testing, Compensating Energy

Major Air Conditioning & Refrigeration

-----Thermodynamics I-II, Air Conditioning & Refrigeration II-III,

Electives (3 credits) ----- Select out of Technical Subjects

Electronics Technology

Related Subjects (29 credits)-- Technical English I-II, Mathematics I-III, Statistics, Science I-II, Human Relations, Organization & Management, Industrial Economics, Project Preparation

Basic Technological Subjects (43 credits)
----- Electric Circuits analysis, Electronic Circuits I-III, Electronic Instrument & Measurement, Digital Circuits I-II, Microprocessor Technology I, Industrial Electronics I, Communication System, Project

Technological Subjects (16-20 credits)

Major Industrial Electronics--Fundamentals of Mechanics, Electrical Mechanics & Controlling Circuits, Fluid & pneumatic Controlling Techniques, Industrial Electronics II, Microcomputer Application in Industry

Major Electronic Computer Technology

----- Microprocessor Technology II, Introduction to Computer Programming Language, Computer Technology, Micro Computer Interfacing Techniques

Major Communication Technology

----- Transmitter-Receiver Technology, Transmission & Modulation System, Transmission Line & Antenna, Telecommunication System, UHF Techniques

Electives (8 credits) ----- Select out of Technical Subjects

Instrumentation & Process Control Technology

Related Subjects (22 credits)-- Technical Mathematics I-II, Fluid Mechanics, Thermodynamics, Technical English I-II, Human Relations, Principle of Researching and Report Writing, Organization & Management, Industrial Economics, Occupational Environment & Techniques of Safety Management

Basic Technological Subjects (33 credits)

----- Metallurgy, Basic Instrumentation Control, Electric Circuits, Electric Meters, Industrial Electricity, Mechanical Control, Electronic Devices, Electronics Circuits, Industrial Electronics, Digital Circuits, Microprocessor Technology

Technological Subjects (34 credits)

----- Basic Automatic Control, Sensor and Transducer, Pneumatic Industrial Instruments, Electronic Industrial Instruments, Pneumatic Industrial Instruments, Electronic Industrial Instruments, Pneumatic Process Controlling Machine, Electronic Process Controlling Machine, Sequential Control, Industrial Electronic Inspection & repair, Computer and Industrial Application, Quality Control, Engineering Measurement & Controlling Procedure

Electives (5 credits) ----- On-the-job Training, Computer Software Application, Production Control, Industrial Pneumatics & Hydraulics, Energy Conservation, Applied Mathematics, Electromagnetic Theory

Mechatronics Technology

Related Subjects (20 credits)-- Technical English I-II, Mathematics I-II, Science I-II, Human Relation, Organization & Management, Industrial Economics, Research Procedure & Report Writing

Basic Technology Subjects (41 credits)

----- Electrical Circuits Theory, Mechanics Practice, Machine Parts, Electronic Instrumentations, Mechanical Drawing and Reading, Industrial Electricity, Digital Circuit Design, Microprocessor

Technology, Precision, Basic Computer Program, Plant Maintenance, Linear Circuit Design, Pneumatics & Hydraulics

Technology Subjects (22-26 credits)

----- Interface Micro-Computer Techniques, Transducer & Application, Electronic Power, Process Control, Automatic Control CNC mechanics and Application, Project

Electives (8 credits)

----- Micro-Computer Application in Industry, Numerical Control System, Mechatronic Maintenance, Electronic Electricity Mathematics, Numerical Analysis, Industrial Electricity Control, On-the Job Training, Workshop Technology, Strength of Materials, Machine Parts Design, Advanced Science for Mechatronics

Appendix 2.6 The Number of Students Planned by PTC (1991-1996) (1/2)

Faculty/Department Course	1991			1992			1993			1994			1995			1996		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Diploma Course (PWS)																		
1. Metal Technology Faculty																		
1.1 Production Technology Dept.	90	86	16	90	90	31	90	90	30	90	90	30	90	90	30	90	90	30
1.1.1 Machine Tools	20	19	16	20	20	-	20	20	-	20	20	-	20	20	-	20	20	-
1.1.2 Tool & Die making	35	35	-	35	35	15	35	35	15	35	35	15	35	35	15	35	35	15
1.1.3 Plastic Molding	35	32	-	35	35	16	35	35	15	35	35	15	35	35	15	35	35	15
1.2 Mechatronics Dept.	-	-	-	-	-	-	20	-	-	40	20	-	40	40	-	40	40	-
2. Industrial Technology Faculty																		
2.1 Industrial Technology Dept.	80	70	10	80	80	12	80	80	40	80	80	40	80	80	40	80	80	40
2.1.1 Production	-	37	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.1.2 Installation & Maintenance	80	33	-	80	80	12	80	80	40	80	80	40	80	80	40	160	80	40
3. Automechanic Technology Faculty																		
3.1 Automotive Technology Dept.	120	193	61	160	120	33	160	160	40	160	160	40	160	160	40	160	160	40
3.1.1 Automobile	120	110	61	120	120	33	120	120	40	120	120	40	120	120	40	120	120	40
3.1.2 Power Plant	-	83	-	40	-	-	40	40	-	40	40	-	40	40	-	40	40	-
4. Electrical Power & Electronic Technology Faculty																		
4.1 Electrical Power Dept.	200	131	61	200	200	40	200	200	80	200	200	80	200	200	80	200	200	80
4.1.1 Installation & Control	80	82	19	80	80	40	80	80	40	80	80	40	80	80	40	80	80	40
4.1.2 Electric Machine	80	21	14	80	80	-	80	80	40	80	80	40	80	80	40	80	80	40
4.1.3 Airconditioning and Refrigeration	20	10	13	20	20	-	20	20	-	20	20	-	20	20	-	20	20	-
4.1.4 Building Maintenance and Technical Engineering	20	18	15	20	20	-	20	20	-	20	20	-	20	20	-	20	20	-
4.2 Electronics Dept.	160	151	58	160	160	40	160	160	40	160	160	40	160	160	40	160	160	40
4.2.1 Industrial Electronics	80	36	12	80	80	-	80	80	40	80	80	40	80	80	40	80	80	40
4.2.2 Computer Electronics	40	80	26	40	40	40	40	40	-	40	40	-	40	40	-	40	40	-
4.2.3 Communication	40	35	20	40	40	-	40	40	-	40	40	-	40	40	-	40	40	-
4.3 Industrial Instrumentation and Process Control Dept.	40	36	-	40	40	-	40	40	-	40	40	-	40	40	-	40	40	-
Total	690	667	206	730	690	156	750	730	230	770	750	230	770	770	230	770	770	230
The number of Diploma Students may be decreased due to increasing number of Higher Diploma Student.																		
Diploma Course (PWT)																		
1. Applied Science Faculty																		
1.1 Industrial Chemistry Dept. (Petrochemical Industry)		37	-	40	-	-	40	40	-	40	40	-	40	40	-	40	40	-
Total		37	-	40	-	-	40	40	-	40	40	-	40	40	-	40	40	-

Remarks: 1, First year
2, Second year
3, Evening course
Source: PTC

Appendix 2.6 The Number of Students Planned by PTC (1991-1996) (2/2)

Dept./Major Course	1991			1992			1993			1994			1995			1996		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Higher Diploma Course (Professional Degree)																		
1. Production Technology Dept.	65	29	-	65	65	-	65	65	-	65	65	-	65	65	-	65	65	-
- Major Machine Tool	45	15	-	45	45	-	45	45	-	45	45	-	45	45	-	45	45	-
- Major Welding & Fabrication	20	14	-	20	20	-	20	20	-	20	20	-	20	20	-	20	20	-
2. Mechanical Technology Dept.	20	14	-	20	20	-	20	20	-	20	20	-	20	20	-	20	20	-
- Major Automobile Technique	20	14	-	20	20	-	20	20	-	20	20	-	20	20	-	20	20	-
3. Electrical Technology Dept.	90	28	-	90	90	-	90	90	-	90	90	-	90	90	-	90	90	-
- Major Electrical Power	45	18	-	45	45	-	45	45	-	45	45	-	45	45	-	45	45	-
- Major Electrical Telecommunication	45	10	-	45	45	-	45	45	-	45	45	-	45	45	-	45	45	-
4. Industrial Instrumentation Technology Dept.							20	-	-	20	20	20	20	40	20	20	40	20
5. Civil Engineering Dept.	-	-	-	-	-	-	20	-	-	20	20	20	20	40	20	20	40	20
6. Mechatronics Dept.							20	-	-	20	20	20	20	20	20	20	20	20
- Major Production Technique	-	-	-	-	-	-	20	-	-	20	20	20	20	20	20	20	20	20
Total	175	71	-	175	175	-	235	175	-	235	235	60	235	275	60	235	275	60
Total of student	865	775	206	945	865	156	1025	945	230	1045	1025	290	1045	1085	290	1045	1085	290

Remarks: 1, First year
2, Second year
3, Evening course

Source: PTC

Appendix 2.7 Other Institutes for Vocational Education (1/3)

Institute	Minburi Technical College	Samutprakan Technical College	Rajamangala Institute of Technology (Northern Bangkok Campus)	King Mongkut's Institute of Technology (Ladkrabang Campus)	KING Mongkut's Institute of Technology (Northern Bangkok Campus)
Administrative Agency	DOVE	DOVE	RIT	Ministry of University Affairs	Ministry of University Affairs
History	1937 est. as a woodworking institute 1978 Status changed to technical college 1990 Moved to suburb of Minburi. engineering equipment lab transferred.	1938 est. as a woodworking institute 1969 Status changed to technical college 1987 Began production technology course with help from DOVE, UNDP, & ILO	1975 est. as a technical college to present	1961 est. as Electric Communication Training Center under Japanese Technical Cooperation 1970 change status to KMIT To present.	1971 est. as technical college incorporated an affiliated technical college within the campus Technical Engineering Course
Technical Engineering Course	PWC	3 departments	8 departments	5 departments	1 department
	PWS	5 dept. (Production, Bldg. Construction, Auto-mechanics, metal Fabrication, Electric Power Technology)	7 dept. (Electronics, Industrial Technology, Bldg. Construction, production, auto-mechanics, metal Fabrication, Electrical Power technology)	8 dept. (Mechanical Power, Tool/Die-making, Metals, Electrical Power, Electronics, Technical Computer, CNC, Engineering Drawing)	13 dept. (Industrial Mechanics, Auto-mechanics, Machine Shop Mechanics, Air Conditioning & Refrigeration, Mechatronics, Industrial Electrical Mechanics, Civil Engineering, Mechanical Drawing, Woodworking, Mechanics, etc.)
	PWT	-	2 departments (Mechanical Drawing, electric engineering)	-	-
	B.S.	-	-	12 dept. (Telecommunication, Electricity, Electronics, Instrumentation, Computer, Mechanical Engineering)	NA
	M.S.	-	-	2 dept. (Electrical, Mechanical Engineering)	NA
	Ph. D.	-	-	1 dept. (Electrical Engineering)	NA

Appendix 2.7 Other Institutes for Vocational Education (2/3)

Institute		Minburi Technical College	Samutprakan Technical College	Rajamangala Institute of Technology (Northern Bangkok Campus)	King Mongkut's Institute of Technology (Ladkrabang Campus)	KING Mongkut's Institute of Technology (Northern Bangkok Campus)
Technical Engineering Course	No. of Students	2,193 (1989)	2,091 (1985)	2,020 (1989)	PWC, PWS B.S. course M.S. course Ph. D. Course Total number of undergraduate students: 5,688 Option to transfer from PWS to upper level 3-4 year course	PWC = 934 students (1985) PWS = 1,221 students (1985) Option to transfer from PWS to university level 3-4 year course.
Faculty Members	Employment Rate of Graduates	121 PWS: 100% as of 1988	215 (of which 79 are technical) PWS: 416 (1990) 82% employed, 12% continued studies, 6% unknown	150	468 100% employment	NA NA
Machine Tools		Manual Machine Tools sufficient. NC Electric Discharge Machine AGIE(1), Profile Projector, Press, Milling Machine, Cylinder Liner Honing Machine, Plastic Injection Molding Machine, 1 Robot (spot welding). No CAD/CAM, CNC Machines	Manual Machine Tools sufficient. 2 CNC Milling Machine DEKEL, 1 Electric Discharge Machine, 1 Composite Lathe Machine, Machining Center, 11 CAD/CAM, Equipment are sufficient.	Manual Machine Tools sufficient. 3 CNC Machine 1 NC Milling Machine CAD/CAM The institute has enough equipment with the exception of CAD/CAM.	Manual Machine Tools sufficient. 1 CNC Milling Machine 1 Electric Discharge Machine 1 Wire Cut Electric Discharge Machine CAD/CAM Trainer Units Universal Testing Equipment Gasoline Engine & Mechanics Trainer Units. LSI Plate Making Units. Equipment is sufficient	Manual Machine Tools sufficient. 1 CNC Electric Discharge Machine 1 CNC Grinding Machine. 1 CNC Milling Machine 10 CAD/CAM control Trainers etc. and available.
Electric & electronics Equipment		15 PC (Tavon) 3 Personal Computer Trainers, 16 Oscilloscopes, Pneumatic Trainer Unit, Electric Circuit Trainer Units. There is an overall shortage of equipment	40 PC (Tavon), 12 Electric Trainers, Several Oscilloscopes, 22 Testers, Electric Circuit Trainers available, Equipment is sufficient	15 PC (EKOEL) There are few other electric/electronic equipment Equipment is lacking	50 NEC PC units. Work station system. Sufficient number of electric/electronic trainer units. Equipment is Sufficient.	40 PCL (Acet) 24 Oscilloscopes per room. Basic equipment is shared with university. Equipment is Sufficient.
Audio Visual Equipment		VHS & VTR	Audio Visual Lecture Room & Auditorium	-	Camera, VTR	NA

Appendix 2.7 Other Institutes for Vocational Education (3/3)

Institute	Minburi Technical College	Samutprakan Technical College	Rajamangala Institute of Technology (Northern Bangkok Campus)	King Mongkut's Institute of Technology (Ladkrabang Campus)	KING Mongkur's Institute of Technology (Northern Bangkok Campus)
LL Equipment	-	LL for 40 Students	-	LL facilities installed	NA
Training Program	-	Tied in with private industries to receive trainees	-	Receives trainees in communications Technology from other Asian nations annually since 1987. Trainees in mechanical engineering (mechatronics, CAD/CAM) Planned to be accepted.	NA
Notes	Average technical college. Equipment is lacking for courses in high technology	Among the technical colleges, it has mostly sufficient equipment and enough to teach high technology. Project: Thai government: Building & infrastructure construction UNDP/ILO: Provision of equipment, dispatch of experts Currently, there are two experts from ILO (CAD/CAM & Machine Tools)	Equipment is insufficient for a Technical college.	Equipment, particularly in electric and communications is sufficient.	Equipment is sufficient.

Appendix 2.8 Laboratory Schedule by Each Course per Week

Laboratory Course			Number of Student	Unit: Hour/Week																																		
				IL		ECL		DML		ML		PCL		CAD		PEL		AL		IEL		HPL		TL		IIL		PRO		CNC		MET		TEL		LL		
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
1. Diploma Level																																						
(1) Mechatronics Course				40	6	0	6	6	6	12	0	12	6	6	10	12	0	6	6	0	0	0	6	0	6	0	6	0	0	6	6	12	0	0	0	4	4	
(2) Industrial Electronics Course				80	12	24	12	24	18	12	18	12	12	0	12	0	24	0	0	12	12	0	12	12	0	12	0	12	0	12	12	0	0	12	0	8	8	
(3) Instrumentation & Process Control Course				40	6	6	6	6	6	6	0	6	6	6	4	12	6	6	0	6	12	6	0	6	0	6	0	12	12	6	0	0	0	0	0	4	4	
Sub Total				160	18	12	30	24	36	30	30	18	30	24	12	26	24	30	12	6	18	24	6	18	12	12	0	24	12	24	18	6	12	0	12	0	16	16
2. Higher Diploma Course																																						
(1) Machine Tool Course				45									6	6	6	2				2									6	12	6				3	3		
(2) Fabrication Course				20								3	3	3					1											2					3	3		
(3) Automechanics Course				20								3	3	3																						3	3	
(4) Electrical Power Course				45								6	6		6	6																				3	2	
(5) Electric Telecommunication Course				45		6	6						6	6								6													6	3	2	
Sub Total				175		6	6					24	24	9	8	6			3	6								6		12	8			6	15	13		
Grand Total				335	18	18	36	24	36	30	30	18	54	48	21	26	32	36	12	6	21	30	6	18	12	12	0	24	18	24	30	6	20	0	12	0	31	29

Remarks: (1) A: 1st Semester + 2nd Semester B; 3rd Semester + 4th Semester

- (2) IL-Instrumentation Laboratory, ECL-Electronic Device and Circuit Laboratory, DML-Digital Electronics and Microprocessor Laboratory, ML-Microcomputer Laboratory, PCL-Personal Computer Laboratory, CAD-Computer Aided Design Laboratory, PEL-Power Electronics and Electric Drive Laboratory, AL-Automatic Control Laboratory, IEL-Industrial Electronics Laboratory, HPL-Hydraulics and Pneumatics Laboratory, TL-Transducer Laboratory, IIL-Industrial Instrumentation Laboratory, PRO-Process Control Laboratory, CNC-CNC Machining Workshop, MET-Metrology Laboratory, TEL-Telecommunication Laboratory, LL-Language Laboratory.

(3) Number of students for experiment/practice except LL is 20 and that for LL is 40.

(4) Above hours exclude evening course.

Source: PTC

Course, Subjects		IL	IEL	DMIL	ML	PCL	CAD	PEL	AL	IEL	HPL	TL	III	PRO	CNC	MET	TEL	Unit: Hour/Week	
		A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B		
Laboratory																			
Mechanics Course (40 Subjects)																			
Basic Technology Subjects																			
DMC5604	Micrology						6									6			
DMC119	Pneumatics and Hydraulics																		
DMC1301	Electronic Instrumentations	6																	
DMC1202	Linear Circuit Design		6																
DMC1401	Digital Circuit Design			6															
DMC2403	Microprocessor Technology I				6														
DMC1402	Basic Computer Programming					6													
DET4406	Computer Programming Language							6											
DMC1113	Industrial Electricity Technology Subjects																		
DMT4408	Interface Microcomputer Techniques				6							6							
DMT3201	Transducer and Application																		
DMT3204	Power Electronics							6						6					
DMT3302	Process Control														6				
DMT3303	Automatic Control																		
DMT3102	CNC Mechanics and Application																		
DIT5402	Computer Software Application						4												
Elective Technology Subjects																			
DME3409	Microcomputer Application in Industry																		
DME9304	Numerical Control System																		
DME9205	Numerical Analysis																		
DME2103	Machine Parts Design						6												
DME9103	Mechanics Maintenance																		
Related Subjects																			
DRE1181	Technical English I																	2	
DRE2102	Technical English II																	2	
Japanese Language I-II																			
Total		0	6	0	6	6	10	12	0	6	0	0	6	0	0	6	12	0	0

Remarks: (I) A; 1st Semester + 2nd Semester B; 3rd Semester + 4th Semester

(2) IL-Instrumentation Laboratory, ECL-Electronic Device and Circuit Laboratory, DML-Digital Electronics and Microprocessor Laboratory,

ML-Microcomputer Laboratory, PCL-Personal Computer Laboratory, CAD-Computer Aided Design Laboratory, PEL-Power Electronics and

Electric Drive Laboratory, AL-Automatic Control Laboratory, IEL-Industrial Electronics Laboratory, HPL-Hydraulics and Pneumatics Laboratory,

TL-Transducer Laboratory, ILL-Industrial Instrumentation Laboratory, PRO-Process Control Laboratory, CNC-CNC Machining Workshop, Electric Drive Laboratory, PL-Plastic Laboratory, ILL-Industrial Machine Tools Laboratory, PSL-Physics and Mechanics Laboratory

MET-Metrology Laboratory, TEL-Telecommunication Laboratory, LL-Language Laboratory.

(3) Number of students for experiment/practice except LL is 20 and that for LL is 40.

(4) Above hours exclude evening course.

Source: PTC

Appendix 2.9 Laboratory Schedule by Subjects per Week (2/3) (Diploma Level)

Course, Subjects		Unit: Hour/Week																		
		IL	ECL	DML	ML	PCL	CAD	PEL	AL	IEL	HPL	TL	IIL	PRO	CNC	MET	TEL	LL		
Laboratory		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Industrial Electronics Technology Course (80 students)																				
Basic Technology Subjects																				
DET1201 Electronic Circuits I			12																	
DET1202 Electronic Circuits II			12																	
DET2203 Electronic Circuits III			12																	
DET1301 Electronic Instruments and Measurement		12																		
DET1401 Digital Circuits I				12																
DET1402 Digital Circuits II				12																
DET2403 Microprocessor Technology I					6															
DET4404 Microprocessor Technology II					6															
DET4408 Microprocessor Interfacing Techniques					12															
DET4405 Introduction to Computer Programming					12															
DET4406 Computer Programming Language					12															
Technology Subjects																				
DET3409 Microcomputer Application in Industry					12															
DET1501 Industrial Electronics I										12										
DET3504 Hydraulic and Pneumatic Controlling Circuits											12									
DET3502 Electrical Mechanics and Controlling Circuits												12								
DMT3102 Numerical Control Machine																				
DET3503 Fundamental Mechanics																				
DET3505 Industrial Electronics II										12										
DET2601 Communication Systems																				
DIT3402 Computer Software Application								12												
DET1302 Sensors & Transducers												12								
Related Subjects																				
DRE1101 Technical English I																			4	
DRE2102 Technical English II																			4	
Japanese Language I-II																			4	
Total		12	0	24	12	24	18	12	18	12	12	0	12	12	0	0	12	0	8	8

Remarks: (1) A; 1st Semester + 2nd Semester B; 3rd Semester + 4th Semester

(2) IL-Instrumentation Laboratory, ECL-Electronic Device and Circuit Laboratory, DML-Digital Electronics and Microprocessor Laboratory, ML-Microcomputer Laboratory, PCL-Personal Computer Laboratory, CAD-Computer Aided Design Laboratory, PEL-Power Electronics and Electric Drive Laboratory, AL-Automatic Control Laboratory, IEL-Industrial Electronics Laboratory, HPL-Hydraulics and Pneumatics Laboratory, TL-Transducer Laboratory, IIL-Industrial Instrumentation Laboratory, PRO-Process Control Laboratory, CNC-CNC Machining Workshop, MET-Metrology Laboratory, TEL-Telecommunication Laboratory, LL-Language Laboratory.

(3) Number of students for experiment/practice except LL is 20 and that for LL is 40.

(4) Above hours exclude evening course.

Source: PTC

Appendix 2.9 Laboratory Schedule by Subjects per Week (3/3) (Diploma Level)

Course, Subjects	Laboratory	Unit: Hour/Week																
		IL	ECL	DML	ML	PCL	CAD	PEL	AL	IEL	HPL	TL	IIL	PRO	CNC	MET	TEL	LL
		A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB	A IB
<u>Instrumentation and Process Control Course (40 students)</u>																		
Basic Technology Subjects																		
DIC1202	Basic Instrumentation and Control	6																
DIC1204	Electric Meters	6																
DIC1205	Industrial Electricity							6										
DIC1206	Mechanical Control							6										
DIC1207	Electronic Devices																	
DIC1208	Electronic Circuits		6															
DIC2209	Digital Circuits I								6									
DIC2210	Digital Circuits II		6															
DIC2211	Microprocessor Technology																	
DET9410	Computer Fundamentals					6												
DET4400	Computer Programming Language																	
Technology Subjects																		
DIT1301	Basic Automatic Control								6									
DIT1302	Sensors and Transducers									6								
DIT1303	Pneumatic Industrial Instruments										6							
DIT1304	Electronic Industrial Instruments											6						
DIT2305	Pneumatic Process Controlling Machine												6					
DIT2306	Electronic Process Controlling Machine													6				
DIT2307	Sequential Control																	
DIT2309	Computer and Industrial Application					6												
DIT2311	Engineering Measurement and Controlling Procedure						6											
DIT5404	Industrial Pneumatics and Hydraulics																	
DIT2308	Industrial Electronics Inspection & Repair									12								
DIT5402	Computer Software Application						4											
Related Subjects																		
DRE1101	Technical English I																	2
DRE2102	Technical English II																	2
Japanese Language I-II																		
Total		6	6	6	6	6	4	12	6	6	12	6	0	12	6	0	0	4

Remarks: (1) A; 1st Semester + 2nd Semester B; 3rd Semester + 4th Semester

- (2) IL-Instrumentation Laboratory, ECL-Electronic Device and Circuit Laboratory, DML-Digital Electronics and Microprocessor Laboratory, ML-Microcomputer Laboratory, PCL-Personal Computer Laboratory, CAD-Computer Aided Design Laboratory, PEL-Power Electronics and Electric Drive Laboratory, AL-Automatic Control Laboratory, IEL-Industrial Electronics Laboratory, HPL-Hydraulics and Pneumatics Laboratory, TL-Transducer Laboratory, IIL-Industrial Instrumentation Laboratory, PRO-Process Control Laboratory, CNC-CNC Machining Workshop, MET-Metrology Laboratory, TEL-Telecommunication Laboratory, LL-Language Laboratory.

(3) Number of students for experiment/practice except LL is 20 and that for LL is 40.

(4) Above hours exclude evening course.

Source: PTC

Appendix 2.10 Laboratory Schedule by Subjects per Week (1/2) (Higher Diploma Level)

Course, Subjects		Laboratory		Unit: Hour/Week																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Remarks: (1) A: 1st Semester + 2nd Semester B: 3rd Semester + 4th Semester

- (2) IL-Instrumentation Laboratory, ECL-Electronic Device and Circuit Laboratory, DML-Digital Electronics and Microprocessor Laboratory, ML-Microcomputer Laboratory, PCL-Personal Computer Laboratory, CAD-Computer Aided Design Laboratory, PEL-Power Electronics and Electric Drive Laboratory, AL-Automatic Control Laboratory, IEL-Industrial Electronics Laboratory, HPL-Hydraulics and Pneumatics Laboratory, TL-Transducer Laboratory, IIL-Industrial Instrumentation Laboratory, PRO-Process Control Laboratory, CNC-CNC Machining Workshop, MET-Metrology Laboratory, TEL-Telecommunication Laboratory, LL-Language Laboratory.

(3) Number of students for experiment/practice except LL is 20 and that for LL is 40.

(4) Above hours exclude evening course.

Source: PTC

Appendix 2.10 Laboratory Schedule by Subjects per Week (2/2) (Higher Diploma Level)

Course, Subjects		Laboratory		Unit: Hour/Week																	
				IL	ECL	DML	ML	PCL	CAD	PEL	AL	IEL	HP/L	TL	IIL	PRO	CNC	MET	TEL	LL	
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
<u>Electrical Power Course (45 students)</u>																					
Basic Subjects																					
132-113	English I																			3	
132-123	English II																				2
DET-9410	Computer Fundamentals					6															
DET-4406	Computer Programming Language					6															
Elective Subjects																					
424-313	Electrical Machine III							6													
424-413	Electrical Machine IV							6													
<u>Electronic Telecommunication Course (45 students)</u>																					
Basic Subjects																					
132-113	English I																			3	
132-123	English II																				2
DET-9410	Computer Fundamentals					6															
DET-4406	Computer Programming Language					6															
Elective Subjects																					
423-423	Antenna & Transmission Line																			6	
Elective Education Subjects																					
422-233	Electronic Circuits II		6																		
422-313	Instrument & Measurement II	6																			
422-343	Industrial Electronics II									6											
Total		0	6	6	0		12	12		6	6								6	6	4

Remarks: (1) A: 1st Semester + 2nd Semester B; 3rd Semester + 4th Semester

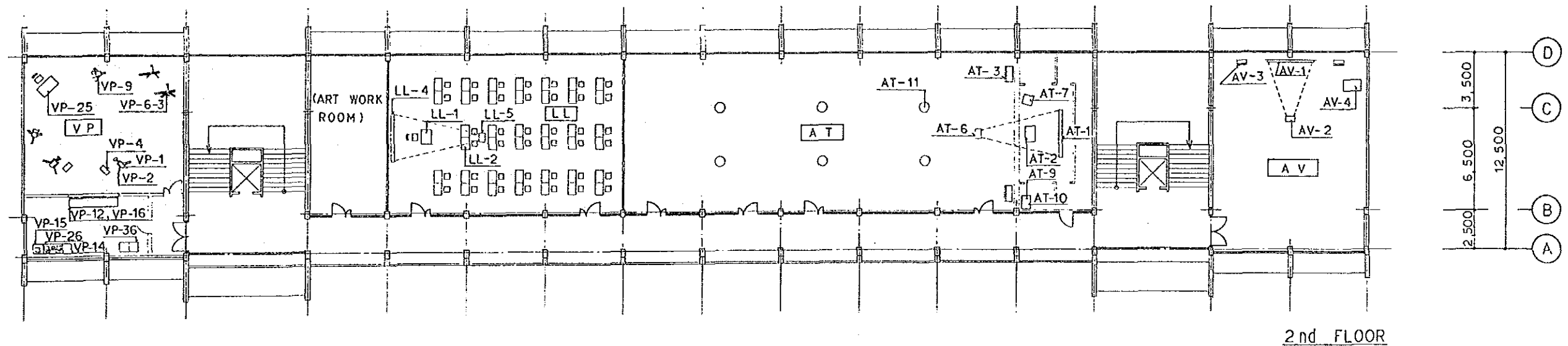
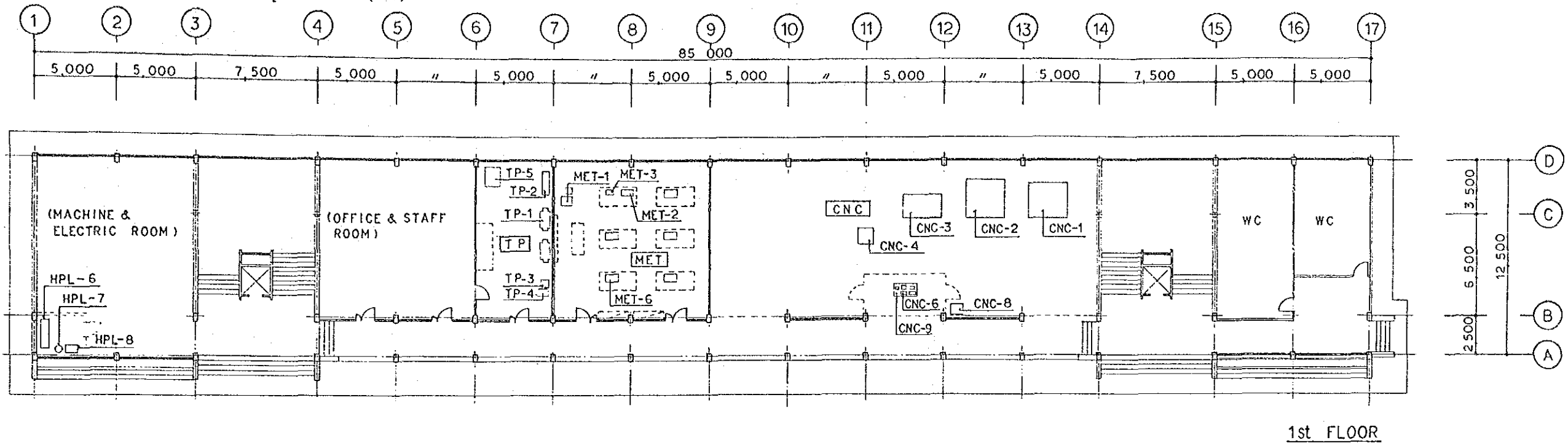
- (2) IL-Instrumentation Laboratory, ECL-Electronic Device and Circuit Laboratory, DML-Digital Electronics and Microprocessor Laboratory, ML-Microcomputer Laboratory, PCL-Personal Computer Laboratory, CAD-Computer Aided Design Laboratory, PEL-Power Electronics and Electric Drive Laboratory, AL-Automatic Control Laboratory, IEL-Industrial Electronics Laboratory, HPL-Hydraulics and Pneumatics Laboratory, TL-Transducer Laboratory, IIL-Industrial Instrumentation Laboratory, PRO-Process Control Laboratory, CNC-CNC Machining Workshop, MET-Metrology Laboratory, TEL-Telecommunication Laboratory, LL-Language Laboratory.

(3) Number of students for experiment/practice except LL is 20 and that for LL is 40.

(4) Above hours exclude evening course.

Source: PTC

Appendix 2.11 Layout Plan (1/3)

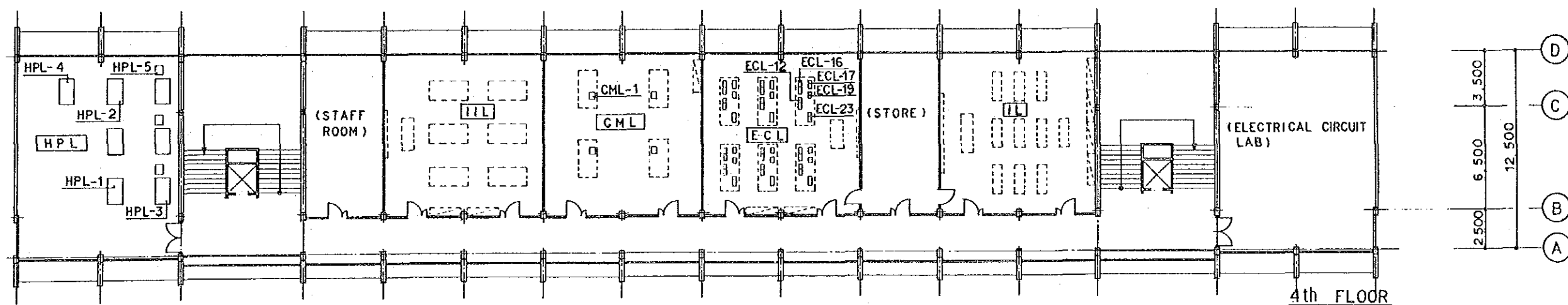


1st FLOOR

ITEM No.	N A M E	ITEM No.	N A M E
TP	TEXT PRINTING ROOM	CNC	CNC MACHINING WORKSHOP
TP-1	Super Digital Duplicator	CNC-1	CNC Wire Cut Electric Discharge Machine
TP-2	Bookbinding Machine	CNC-2	CNC Milling Machine
TP-3	Wordprocessor	CNC-3	CNC Precision Surface Grinding Machine
TP-4	Laser Printer	CNC-4	Handling Robot
TP-5	Copying Machine	CNC-6	CAD/CAM Computer
		CNC-8	UPS Unit
		CNC-9	Table for Computer
			(MACHINE AND ELECTRIC ROOM)
MET	METROLOGY LAB	HPL-6	Air Compressor
MET-1	Coordinate measuring Machine	HPL-7	Air Receiver
MET-2	Roundness Tester	HPL-8	Refrigerated Air Dryer
MET-3	Surface Roughness Tester		
MET-6	Granite Surface Plate		

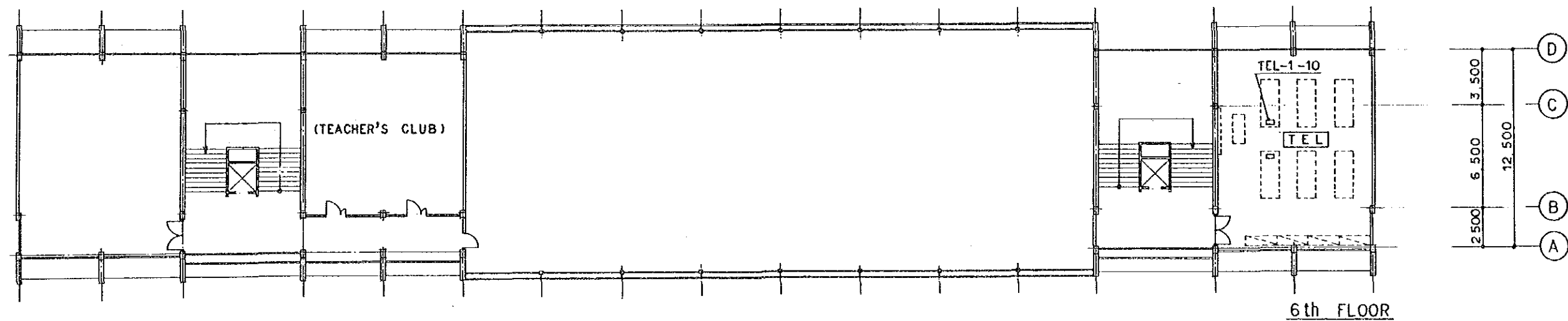
2nd FLOOR

ITEM No.	N A M E	ITEM No.	N A M E
VP	VIDEO PRODUCTION STUDIO	AT	AUDITORIUM
VP-1	3-CCD Color Video Camera	AT-1	Motor-Drive Main Screen
VP-2	Tripod with Dolly	AT-2	Lecture Table
VP-4	Portable Color Video Monitor	AT-3	Main Speaker
VP-6-3	Microphone Stand	AT-6	Video Projector
VP-9	Portable Lighting Kit	AT-7	Visual Presenter
VP-12	Video/Audio Switcher	AT-9	Video Rack
VP-14	Video Typewriter	AT-10	Audio Rack
VP-15	Telop System	AT-11	Ceiling Speaker
VP-16	CRT		
VP-25	Announce Booth Equipment		
VP-26	Editing Console/Rack	AV	AUDIO/VISUAL ROOM
VP-36	Dubbing Rack	AV-1	Motor-Drive Main Screen
LL	LANGUAGE LABORATORY ROOM	AV-2	Video Projector
LL-1	Master Section	AV-3	Main Speaker
LL-2	Booth Section	AV-4	AV Rack
LL-4	Motor-Drive Main Screen		
LL-5	Video Projector		



3rd FLOOR		N A M E	
ITEM No.		ITEM No.	N A M E
DML	DIGITAL ELECTRONICS AND MICROPROCESSOR LAB	CAD	COMPUTER AIDED DESIGN LAB
DML-1	Logic Circuit Trainer	CAD-1	CAD Computer
DML-3	Digital Circuit Trainer	CAD-4	Printer
		CAD-5	Laser Printer
		CAD-6	Image Scanner
ML	MICROCOMPUTER LAB	CAD-7	X-Y Plotter(A3)
ML-12	Personal Computer	CAD-8	X-Y Plotter(A0)
ML-14	Printer(80 Line)	CAD-11	Table for CAD Computer
		CAD-12	Data Display
PCL(1)	PERSONAL COMPUTER LAB(1)	PCL(2)	PERSONAL COMPUTER LAB(2)
PCL-1	Personal Computer	PCL-1	Personal Computer
PCL-4	Printer(80 Line)	PCL-4	Printer(80 Line)
PCL-5	Printer(120 Line)	PCL-5	Printer(120 Line)
PCL-8	Table for Personal Computer	PCL-8	Table for Personal Computer

4TH FLOOR		N A M E	
ITEM No.		ITEM No.	
HPL	HYDRAULICS AND PNEUMATICS LAB	ECL	ELECTRONIC DEVICES AND CIRCUIT LAB
HPL-1	Basic Hydraulic Training Unit	ECL-12	Dual Trace Oscilloscope
HPL-2	Electro-Hydraulic Training Accessory	ECL-16	Universal Counter
HPL-3	Proportional Hydraulic Training Accessory	ECL-17	Function Generator
HPL-4	Electric Pneumatic Training Unit	ECL-19	Semiconductor Characteristic Curve Tracer
HPL-5	Programmable Controller	ECL-23	Amplifier Circuit Trainer
IIL	INDUSTRIAL INSTRUMENTATION LAB		
CML	COMPUTER AIDED MEASUREMENT LAB	IL	INSTRUMENTATION LAB
CML-1	Personal Computer		

[illegible]

N A M E		N A M E	
ITEM No.		ITEM No.	
PRO	PROCESS CONTROL LAB	AL	AUTOMATIC CONTROL LAB
PRO-1	Highway Gateway	AL-1	Sequence Control Experimental Equipment
PRO-2	Application Module	AL-3	Servo-Feedback Control Trainer
PRO-3	Advanced Multifunctional Controller		
		PEL	POWER ELECTRONICS AND ELECTRIC DRIVES LAB
IEL	INDUSTRIAL ELECTRONICS LAB	PEL-1	DC Servomotor Trainer
IEL-1	Transister Inverter Training Unit	PEL-2	Stepping Motor Trainer
IEL-2	Robot Model	PEL-4	Positioning Control
IEL-3	Three Dimensions Robot	PEL-5	Pneumatic Control Simulator
IEL-4	Personal Computer	PEL-9	Universal Counter
IEL-6	Printer(80 Line)		
IEL-8	Flexible Manufacturing System	TL	TRANSDUCER LAB
		TL-1	Instrumentation Transducer Unit

[illegible]

Appendix 2.12 Abbreviations of Laboratory/Other Room Names

1. IL - Instrumentation Laboratory
2. ECL - Electronic Device and Circuit Laboratory
3. DML - Digital Electronics and Microprocessor Laboratory
4. ML - Microcomputer Laboratory
5. PCL - Personal Computer Laboratory
6. CAD - Computer-Aided Design Laboratory
7. PEL - Power Electronics and Electric Drive Laboratory
8. AL - Automatic Control Laboratory
9. CML - Computer Aided Measurement Laboratory
10. IEL - Industrial Electronics Laboratory
11. HPL - Hydraulics and Pneumatics Laboratory
12. TL - Transducer Laboratory
13. IIL - Industrial Instrumentation Laboratory
14. PRO - Process Control Laboratory
15. CNC - CNC Machining Workshop
16. MET - Metrology Laboratory
17. TEL - Telecommunication Laboratory
18. VP - Video Production Studio
19. AT - Auditorium
20. AV - Audio Visual Room
21. TP - Printing Room
22. LL - Language Laboratory

Appendix 2.13 Mechanical & Electrical Works by Thai Side

Facility Planning

The Project does not require special facilities. Although works pertaining to facility will be undertaken by the Thai side, the following points regarding equipment installation and operation should be heeded.

(1) Water Supply/Sewerage Facilities

The CNC machine installed in the CNC Machining Workshop on the first floor required a supply of cold water. Cold water is supplied by a batch system; and it is unnecessary to directly connect the machine to the water supply pipe. However, it is necessary to install several taps. In order to eliminate facets, it is necessary to install a sewage catch basin with filter.

(2) Electric Facilities

Generally the electric wiring in each room will be buried wiring in the slab and wall. However, the electric terminals in the LL rooms, CAD and personal computer training rooms, the power and signal lines, and the plug receptacles of each lab counter will be concealed wiring in the floor, in order to be out of the student's way as they move about the rooms. Exposed wiring using ducts or cable racks will provide electric power wiring for CNC machinery, etc.

(3) Air Conditioning and Ventilation Facilities

Air conditioners will be installed in rooms utilizing computers or measuring devices in order to maintain equipment precision. Generally, the rooms will be naturally ventilated, but ventilation fans will be installed according to the grade three ventilation system. The communication lab will require curtains to darken the room and air conditioning during optical fiber experiments.

(4) Air Supply facilities

The Hydraulics and Pneumatics and Automatic Control Labs require a compressed air source. Compressed air will be created by an air compressor in the machine room on the first floor and supplied by a pipe. For rooms containing machines using only a small volume of compressed air, a portable type small air compressor will be installed in the same room to supply compressed air.

