Ⅷ　付　属　資　料

SINGAPORE TECHNICAL INSTITUTE
CIRCUIT ROAD, SINGAPORE 1337

COURSE: MECHANICAL ENGINEERING

LEVEL: INDUSTRIAL TECHNICIAN CERTIFICATE

DURATION: 2 YEAR FULL-TIME

ENTRY QUALIFICATIONS:
General Certificate of Education Ordinary Level
Grade 1 - 6 in Elementary Mathematics
Grade 1 - 8 in English
Grade 1 - 8 in either Physics, Physical Science or Engineering Science or,
Grade 1 - 6 in General Science

Preference is given to those who have, in addition, obtained Grade 1 - 8 in Metalwork and/ or Additional Mathematics.

ADMISSION: There are two intakes a year - one in March and the other in September. For the March Intake exercise, applications must be made under the Joint Admission System.
For the September Intake exercise, advertisements inviting applications will be published in the press between June and August.

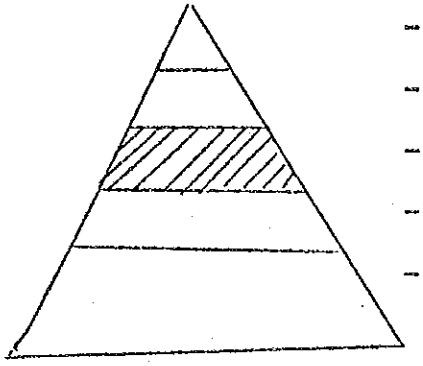
COURSE SYNOPSIS: The aim of the course is to provide practical training and engineering education to enable the graduate, on leaving the institute to obtain employment in the Mechanical Engineering or related industries. The course comprises 60% practical work supported by a good understanding of basic engineering principles.

The 2 years' full-time course is divided into 4 semesters - each semester being 21 weeks. The Industrial Technician Certificate is awarded on successful completion of the practical course work and satisfactory performance in the final examinations.

Apart from the course studies, arrangements are also made for full-time students to obtain practical experience at industrial establishments. Trainees in the second-year are attached for in-plant training at these establishments for a period of about five weeks.

Course Outline	Hours
Tool Design	126
Engineering Drawing	252
Engineering Metrology	168
Mechanical Maintenance Theory & Practice	126
Mechanical Technology	168
Electricity	84
Fluid Power	84
Production Technology	168
Manufacturing Processes	252
Materials and Processes	126
Fitting, Welding, Shaping & Sheetmetal Fabrication	168
Machining Practice	840
Technical English & Mathematics	210
Industrial Studies	84
Physical Education	84
Total:	2940

JOB
OPPORTUNITIES:



- Technologist (Engineer, University Graduate)
- Higher Technician (Engineering Technician Diploma)
- Industrial Technician
- Craftsman (Tradesman/Artisan)
- Operator (Factory Hand)

The Mechanical Industrial Technician does the finer details of production planning, aids the engineering technician with inspection and organises the maintenance and repair of factory equipment. He may carry out productive tasks which call for a wider range of skills and related expertise than is normally possessed by a craftsman.

Examples of some of the job opportunities are mechanical or production personnel, technical assistances, technical sales representative, etc. Promotion to supervisory level will depend on their performance at the floor level.

SINGAPORE TECHNICAL INSTITUTE
CIRCUIT ROAD, SINGAPORE 1337

COURSE: MECHANICAL ENGINEERING DRAWING & DESIGN

LEVEL: INDUSTRIAL TECHNICIAN CERTIFICATE

DURATION: 2 YEARS FULL-TIME

ENTRY QUALIFICATIONS:
General Certificate of Education Ordinary Level
Grade 1 - 6 in Elementary Mathematics
Grade 1 - 8 in English
Grade 1 - 8 in either Physics, Physical Science or Engineering Science or
Grade 1 - 6 in General Science

Preference will be given to those who have, in addition, obtained Grade 1 - 8 in Metalwork, Geometrical & Mechanical Drawing and/or Additional Mathematics.

ADMISSION: There are two intakes a year - one in March and the other in September. For the March Intake exercise, applications must be made under the Joint Admission System. For the September intake exercise, advertisements inviting applications will be published in the press between June and August.

COURSE SYNPOSIS: The aim of the course is to train people capable of working in the drawing office as draughtsmen. The graduate would normally seek employment in a junior capacity in a mechanical drawing office and be involved initially in detail draughting, requiring a good knowledge of drawing techniques and production processes. After adequate experience, he could become involved in design, requiring practical workshop experience, mechanical technology and costing.

The course is made of three segments:

i) Practical, ii) Theory and iii) Drawing & Design.

The practical workshop experience enables the trainees to develop a more pragmatic approach in design work to ensure that the requirements of the design are no more stringent than necessary, thus keeping production times and costs to a minimum.

The theory segment of the course provides a background in engineering science, which includes mechanical technology, electricity and materials and processes.

The third segment of the course deals with the techniques of drawing, principles of design, engineering graphics, drawing office practice and organisation, the design of machine elements, piping and structural drawing.

Course Outline	Hours
Mechanical Engineering Drawing & Design	672
Tool Design	168
Engineering Drawing	252
Engineering Metrology	84
Mechanical Technology	336
Electricity	84
Materials & Processes	210
Manufacturing Processes	210
Fitting, welding, shaping and sheetmetal fabrication	168
Machining Practice	378
Technical English & Mathematics	210
Industrial Studies	84
Physical Education	84
Total;	2940

JOB OPPORTUNITIES:

Some of them are:

Design Assistant

Technical Assistant

Draughtsman

Production Supervisor

Technical Sales Representative

Vocational Instructor

Training Officer

REQUEST FROM THE SINGAPORE ECONOMIC DEVELOPMENT BOARD FOR TECHNICAL CO-OPERATION FROM THE GOVERNMENT OF JAPAN FOR THE EXPANSION AND UPGRADING OF THE JAPAN-SINGAPORE TRAINING CENTRE (JSTC)

1. Overview

The restructuring of the Singapore economy, with emphasis on higher productivity through automation and computerisation, has created a profound impact on the training of manpower for the industries in Singapore. The Economic Development Board (EDB) has been keeping tab on the changing technologies and manpower demand patterns of the industries with the view to constantly upgrade our training programmes. With this in mind, the Singapore Government approved S$2.5 m for the establishment of a CNC machine training section in the Metalworking Department in the Japan-Singapore Training Centre (JSTC). To successfully implement CNC training in JSTC, we have sought the technical co-operation of the Government of Japan for the services of CNC experts since Japan is the leader in CNC technology.

Since the technical co-operation with the Government of Japan on the JSTC project will expire next year, it is most appropriate to present now the proposal for the upgrading of the JSTC training programmes which have been reviewed by the EDB officers and JSTC experts.

2. Expansion and Upgrading Project

2.1 New Trades & Level of Training

The EDB has obtained the Singapore Ministry of Finance's approval to introduce CNC machining trade in JSTC, and have also arrived at the conclusion that the trades offered by the Electrical and Electronics Department and the Instrumentation Department should be offered at the Industrial Technician level rather than at the Craft level. Due to the changing skilled manpower demand patterns, we have decided to concentrate on certain specialised trades of high skill and technological content which are required by the industries. With the above in mind, we will introduce digital control into the curriculum of the Instrumentation and Control trade and upgrade it to ITC level by calling it Process Control Engineering. The Electrical, Industrial Electronics and Consumer Electronics trades of the EE Department will be amalgamated and expanded to include mechatronics. This EE department will offer Industrial

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Electronics Engineering at ITC level. The total number of apprentices enrolled in this department will be increased from 180 to 280. In the Metalworking Department, the Plastic Mould Making trade will be replaced by Computer Numerical Control Machining trade. The Machinery Maintenance Trade will continue to be offered by the Centre because of the demand for apprentices of this trade. The name of the Centre will be changed to "Japan-Singapore Technical Institute" to reflect the upgrading of the training programmes to Industrial Technician Level.

2.2 Increase in Enrolment

The present total enrolment capacity of the Centre is 400 apprentices. For this new project, it is proposed that the total enrolment capacity be increased to 500 apprentices. The present and proposed enrolment and output figures are given in the table below.

Present			Proposed		
Trade	Max Enrol-ment (apps)	Half-Yearly Output (apps)	Trade	Max Enrol-ment (apps)	Half-Yearly Output (apps)
Machinery Maintenance	80	20	Machinery Maintenance	80	20
Plastic Mould Making	80	20	CNC Machining	80	20
Instrumentation & Control	60	15	Process Control Engineering	60	15
Industrial Elecs Consumer Elecs Electrical Trade	))180)	45	Industrial Electronics Engineering	280	70
Total	400	100		500*	125

*The figure does not include 40 company-sponsored employees for CNC training.

2.3 Building Expansion

For the implementation of this new project, the Centre has to be expanded to accommodate the additional machinery, equipment, staff and apprentices. Presently, there is provision for the erection of one more storey above the administration block and two more storeys above the canteen, giving us a total covered area of 900 sq m. The estimated cost for the building expansion is S$3 m.

2.4 Additional Equipment

The Singapore Government has approved S$2.5 m for the purchase of 7 CNC machines for the Centre. However, additional machinery and equipment will be required for upgrading the trades to ITC level. The estimated additional cost is S$3 m. Funds for the purchase of these additional machinery and equipment will be requested from the Government of Japan.

The additional machinery and equipment are broadly classified as follows:

1. Automatic Control Equipment and related equipment
2. Industrial Electronics Equipment and related equipment
3. Pneumatic Control System and related equipment
4. Hydraulic Control System and related equipment
5. Digital Control System and related equipment
6. Relay Control System and related equipment
7. Computer System and related equipment
8. Micro-processor System
9. Industrial Robots and related equipment
10. Various Equipment for Project Works
11. NTSC to PAL Converter.

The detailed list of equipment will be prepared by the EDB officers and JSTC experts when the project is approved. S$0.2 m will be requested from the Singapore Government for Local Capital Purchases.

2.5 Experts

The number of Japanese experts required for this new project is 7. They are:

1 team leader

2 CNC experts

1 Japanese Language expert

2 Industrial Electronics Engineering experts

1 Digital Control expert for Process Control Engineering.

Short term experts will also be requested when necessary.

2.6 Local Staff

For the additional 100 apprentices, a total of 12 staff, comprising 11 technical staff (using the ratio 1 technical staff: 9 apprentices) and 1 Japanese language teacher, will be needed.

2.7 Scholarships for Local Counterparts

The local counterparts have to be trained in advance in Japan so that they can acquire the new skills and technology to be introduced. This is to ensure that the new project will be successfully implemented. Altogether 12 scholarships will be requested from the Japanese Government for this new project as indicated below:

	Course	No. of Scholarships
1	CNC Programming & Operation/Maintenance	2
2	Industrial Electronics	4
3	Digital Control Engineering	2
4	Japanese Language	2
5	Machinery Maintenance	2
		12

2.8 Duration of Co-operation

The duration of the project will be 5 years, commencing on 29 June 1983, the date when the present JSTC term of co-operation expires.

2.9 Total Project Cost

The table below gives the total project cost to be contributed by the Governments of Japan and Singapore.

SINGAPORE GOVERNMENT		JAPANESE GOVERNMENT	
	S$M		S$M
1. CNC Machines, etc	2.5	1. Machines & Equipment	3
2. Local Capital Purchases	0.2	2. 7 experts (for 5 yrs)	5
3. Building Expansion	3	3. 12 scholarships (first year only)	0.5
4. Additional Operational Cost for 5 yrs ($5COx12mthsx5yrsx1COapps)	3		
	8.7		8.5
TOTAL PROJECT COST : S$17.2M			

3. Localization Plan

After much discussion with the Japanese officials in Singapore, it has been amicably agreed that the localization of the day-to-day management at JSTC be effected on 1st August 1982, since this is the date for the promotion of the local staff. The proposal for the localization will be submitted to the JSTC Management Committee on 5 July 1982 for approval before it is implemented. However, to ensure that the project is successful, the Japanese experts will have to continue providing advice on technical and managerial skills to the local counterparts. The new project will therefore ensure that this objective is fully met.

THE REVISED PROPOSAL FOR JAPAN-SINGAPORE TECHNICAL INSTITUTE (JSTI) PROJECT

INDUSTRIAL TECHNICIAN TRAINING

1. INTRODUCTION

The last decade has seen an enormous upsurge in technological innovations and break-throughs. Keeping pace with not outstripping these innovations, are their applications in manufacturing industries. Of all these applications, the greatest impact made must surely belong to that of electronics, computer/microprocessor applications and their manifestations in the form of CAD/CAM, CNC, industrial robotics and other logical extensions into automatic industrial machinery, equipment and systems.

Such applications will continue to affect industrial manpower at all levels, from management down through designers, engineers, technicians and supervisors to the craftsmen and assembly line operators. They will also continue to permeate manufacturing processes and systems from the largest production lines down to independent small machine shops and toolrooms.

For Singapore to remain competitive on the world markets such innovations and applications must be introduced to our industries. This is reflected in our restructuring policy/programmes of the industries towards more automation and computerisation. The success of restructuring in this direction is dependent to a great extent upon the availability of technical manpower familiar with and able to implement such applications and to maintain/service such equipment/systems. Therefore, to be in line with this policy and to complement the effort of other training institutes in supplying manpower to the industries, the establishment of JSTI aims to train a pool of industrial technician who could perform maintenance/service/ application engineering jobs etc in the fields of industrial electronics, mechatronics and process control engineering. It

is envisaged that these trained personnel with such knowledge of the latest technology at Industrial Technician Certificate (ITC) level will meet the present/future needs of the industries in Singapore. The proposed trainee enrolment capacity, building layout plans and machinery and equipment required are given in Annexes 1, 2 and 3 respectively.

2. MECHATRONICS ENGINEERING (ELECTRONICS-ORIENTED MECHANICAL ENGINEERING

As the term Mechatronics presently does not have a single universally accepted definition, for this proposal, the term Mechatronics is intended to mean "Electronics-Oriented Mechanical Engineering".

2.1 Training Targets:

Upon successful completion of the course, trainees

a) will be able to perform fairly complicated trouble-shooting, repair, fault diagnosis, and preventive maintenance of mechanical, electrical and electronically controlled machines.

b) will be able to produce simple components/parts and design simple circuits in the fields of electrical, electronics, pneumatics and hydraulics.

c) will be able to perform high-level computer language programming, CNC programming, etc.

d) will be able to perform machine inspection/maintenance, installation and quality control of parts/components.

e) will have received a broad base training on electrical/electronics and mechanical engineering studies.

The major subjects which will have to be included in the training syllabus are:

a) Machine tool operations and maintenance
b) CNC technology, programming and machining
c) Mechanical/Electronics repair and service techniques
d) Controls engineering (hydraulics, pneumatics and automatic control)
e) Industrial electronics
f) Microprocessor technology and application
g) Computer technology and programming
h) Industrial robotics

The proposed curriculum is given in Annex 4.

2.2 Job Functions of Graduates

The graduates will be expected to be competent in the applications of mechanical and digital electronics engineering in the operations and maintenance of micro-processor-based equipment and machinery used for industrial automation and computerisation.

2.3 Equipment the graduate will be expected to handle

The various types of industrial production machines in the electronic and precision engineering industries (eg IC wire bonders, automatic insertion machines, pattern-recognition trimming equipment, CNC machines, industrial robots and other mechatronics equipment).

2.4 Potential Employers

Nichicon	-	Custom-made capacitor manufacturing Machines.
Okamoto	-	Manufacturer of machine tools.

Baker Far East	-	Oil field equipment manufacturing, CNC programming, machining and maintenance.
Production Machines	-	Manufacturer of CNC machines.
General Electric	-	Pattern-recognition bonders.
Seagate	-	Automatic insertion equipment maintenance and programming.
George Cohen, CMT etc (vendors for m/c & robots)	-	after sales service/support for industrial robots and CNC machine tools

3. INDUSTRIAL ELECTRONICS ENGINEERING

As the term Industrial Electronics Engineering is widely known, for this proposal, the term Industrial Electronics Engineering is the study of applications of electronics in industries.

3.1 Training Targets:

Upon successful completion of the course, trainees

a) will be able to understand electrical, electronic (mainly digital) circuits and perform trouble-shooting and repair of related equipment.

b) will be able to understand the basic functions of industrial automatic control equipment and perform trouble-shooting and repair of such equipment.

c) will be able to understand the principles and applications of microprocessors, low level machine languages and to perform trouble-shooting and repair of such equipment.

d) will be able to understand the principles and applications of industrial robots and to operate and maintain them.

e) will be able to understand the principles of computer and their peripherals and their maintenance and to programme in high-level computer languages (eg BASIC).

The major subjects which are to be included for upgrading the existing training syllabus are:

a) automatic control
b) pneumatics and hydraulics for control systems
c) relay control, sequential control, etc.
d) microprocessor applications and development
e) microcomputer and computer-aided design
f) industrial robots and
g) industrial electronics.

The proposed curriculum is given in Annex 5.

3.2 Job Functions of Graduates

The graduates will be expected to perform the following duties :

a) Maintain, trouble shoot and service the industrial electronic equipment, mainly in the manufacturing industries (eg 3-phase power control equipment, motor control system, computer-based production machines).

b) Perform simple designing and improvement of industrial electronic machines.

c) Maintenance/handle various electronically controlled machines eg

- Induction heating equipment, soldering machines

- Automatic energy saving cooling systems (processor-controlled air conditioning)

- Computerised measurement systems and testers.

- Conventional power rectification using triac control

3.3 Potential Employers

Hitachi	-	IC bonding
General Motor	-	Autostapling machines
Printed Circuit Ind	-	PCB manufacturing machines
Other factories	-	CNC control panels, CNC drive units, etc.

4 PROCESS CONTROL ENGINEERING

Process Control Engineering is a widely accepted term for the study of the engineering principles of the process control industries.

4.1 Training Targets:

Upon successful completion of the course, trainees

a) will be able to maintain and diagnose digital process control system in oil refinery, chemical plant, etc.

b) will be able to understand the principles in the control of temperature, pressure, flow, etc and to operate process control equipment.

c) will be able to measure process quantities, eg heat, pressure, etc with the use of analogue and digital measurement equipment.

d) will be able to diagnose, maintenance and perform installation work in instrumentation piping, wiring, etc.

e) will have received a broad base training on modern process control engineering principles.

The major subjects which will have to be included in the training syllabus are:

a) electrical measurement and installation

b) process measurement and installation

c) process control principles

d) industrial instruments

e) digital control system

The proposed curriculum is given in Annex 6.

4.2 Job Functions of Graduates

The graduates will be competent in

a) maintaining all conventional and advanced types of process control system (analogue and digital systems)

b) calibrating, programming and carrying out diagnostics on process control systems and instruments

c) maintaining and trouble-shooting process control system

d) servicing advance instrumentation equipment

e) interpreting and carrying out process layout and piping installation.

4.3 Present employment and requirements by the industries

The JSTC has so far produced 31 NTC2 graduates in instrumentation and control (by Nov 1982). These graduates are now working in the following companies:

Companies	No. of Apprentices
1. Shell	5
2. S'pore Refining Co	3
3. Petroleum Corpn S'pore	7
4. Rosemount	1
5. Travenol	1
6. Yokogawa	3
7. Glaxo Chemical	2
8. Fisher Controls	1
9. Foxboro	2
10. Chiyoda	2
11. Kokusai Keiso	1
12. Masoneilan	1

4.4 Potential Employers

1. Petrochemical Industries: BP, ESSO, Shell, Philips, Petroleum Corporation of Singapore, Beecham, Glaxo, etc.

2. Manufacturers of Process Instruments: Masoneilan (valves), Yamatake-Honeywell (meters), Yokogawa (measuring instruments) etc.

3. Turnkey project contractors and maintenance groups: Mcdemolt Engineering, George Kent, Weston, Mathew Hall.

5. JAPANESE EXPERTS

The Economic Development Board (EDB) requested for the despatch of 2 types of experts to JSTI, namely, the long-term experts and the short-term experts:

a) Long-Term Experts

The long-term experts who are required over the 5-year co-operation period will comprise the following:

a) one Project Leader

b) one expert for Mechatronics Engineering Department

c) two experts for Industrial Electronic Engineering Department

d) one expert for Process Control Engineering Department.

The long-term experts will provide technical advice to the Heads of Department and Counterparts on planning and development of curricula and teaching materials, training of counterparts and any other technical matters.

EDB strongly requests that the Project Leader should be the Director of the Institute.

b) Short-Term Experts

In view of the many specialised subjects that will be offered in the various proposed courses, short-term experts are required to assist in expediting the

planning and development of curriculum and teaching materials, and the training of counterparts in the expert's fields of specialisation.

It would be necessary to set aside a certain period of time, within his assignment period, solely for training of counterparts in his field of specialisation. Therefore, the training of counterparts will most likely be conducted in the evening as the counterparts will be involved in teaching during the day.

It is estimated that 187 expert-months will be required for the assignment of short-term experts to JSTI. Please see Annex 7 for detailed schedule for the assignment of short-term experts.

6. Counterparts Training in Japan

In view of the many specialised subjects in the various proposed courses, it would be necessary to further develop the counterparts.

It is proposed that the training in Japan be expedited and confined only to specialised technical studies, as most of the staff had undergone basic Japanese Language and technical training.

It is estimated that 228 counterpart-months will be required for training of counterparts in Japan. Please see Annex 8 for details.

Dated: 21/2/83

WP1388Fnt

ANNEX 1

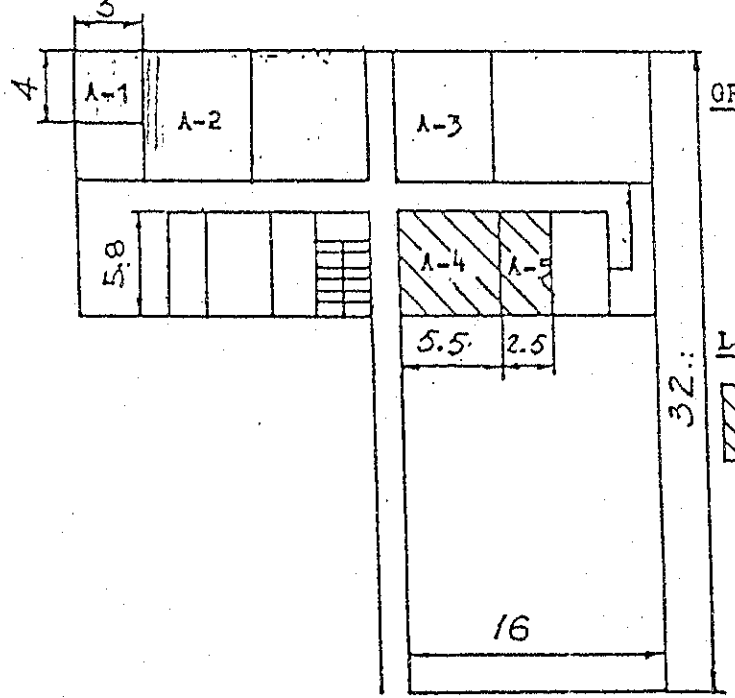
ENROLMENT CAPACITY OF JSTI

COURSES AT ITC LEVEL

S/No	Course	Planned Capacity		
		Enrol-ment.	Intake per 6 months	Annual Intake
1	Process Control Engineering	60	15	30
2	Industrial Electronics Engineering	280	70	140
3	Mechatronics Engineering	160	40	80
	Total	500	125	250

PLAN ON EXPANSION/RENOVATION WORK FOR JAPAN-SINGAPORE TECHNICAL INSTITUTE

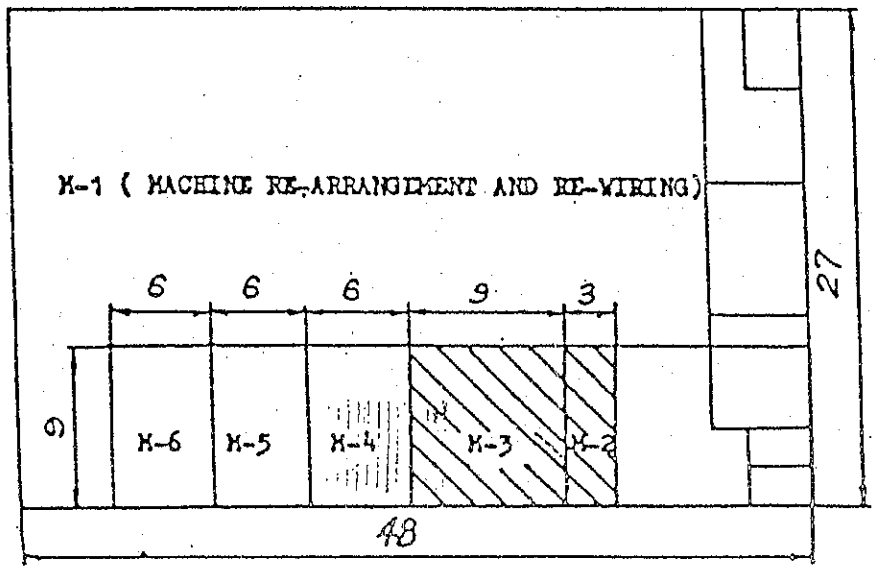
A-1 = Dy DOT's Room
A-2 = Admin Room
A-3 = Meeting Room
A-4 = Expert Room
A-5 = Printing Room
M-1 = Machine Workshop
M-2 = Material Prep Room
M-3 = CNC Programming Lab
M-4 = Metrology Lab
M-5 = Maintenance Lab 1
M-6 = Maintenance Lab 2

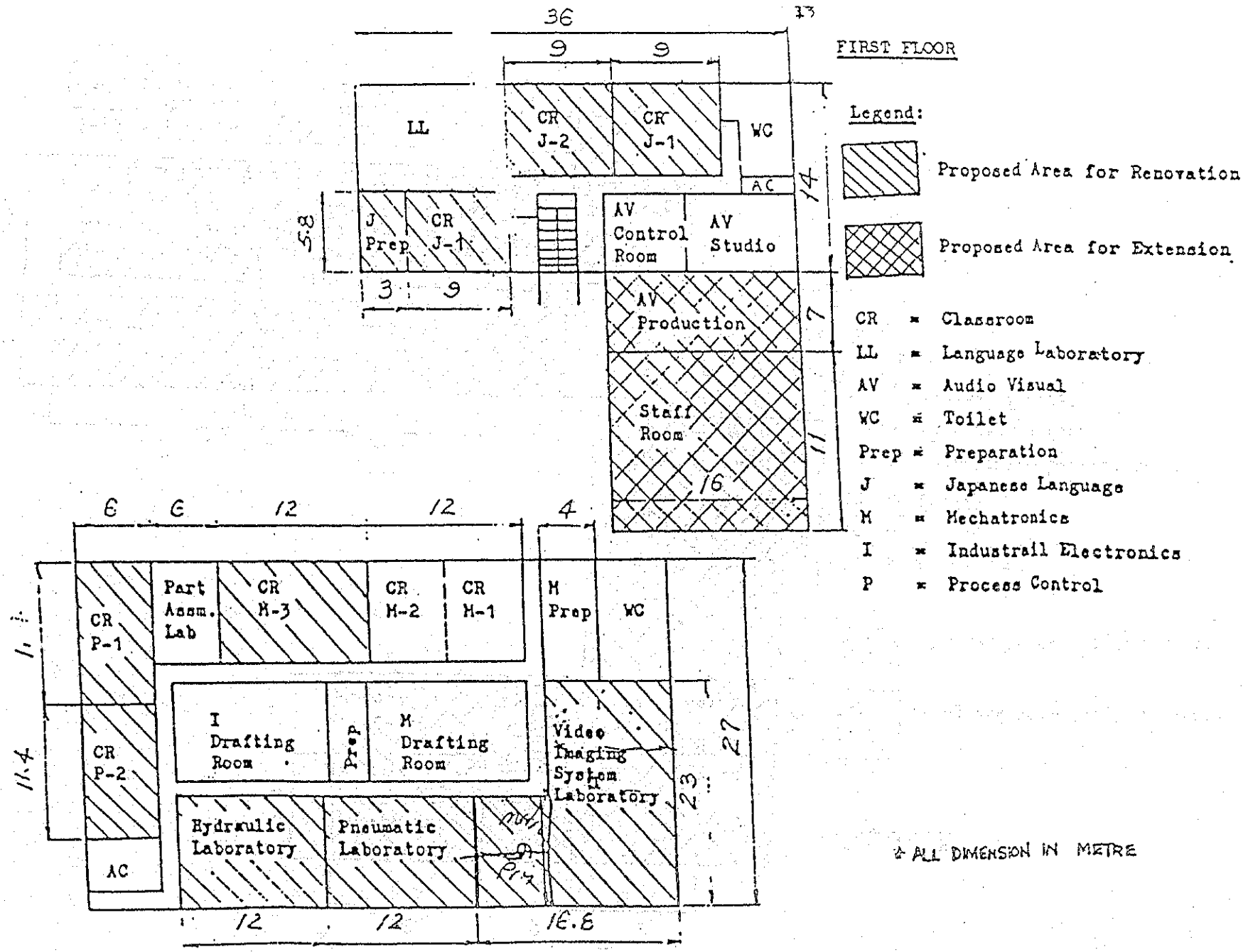


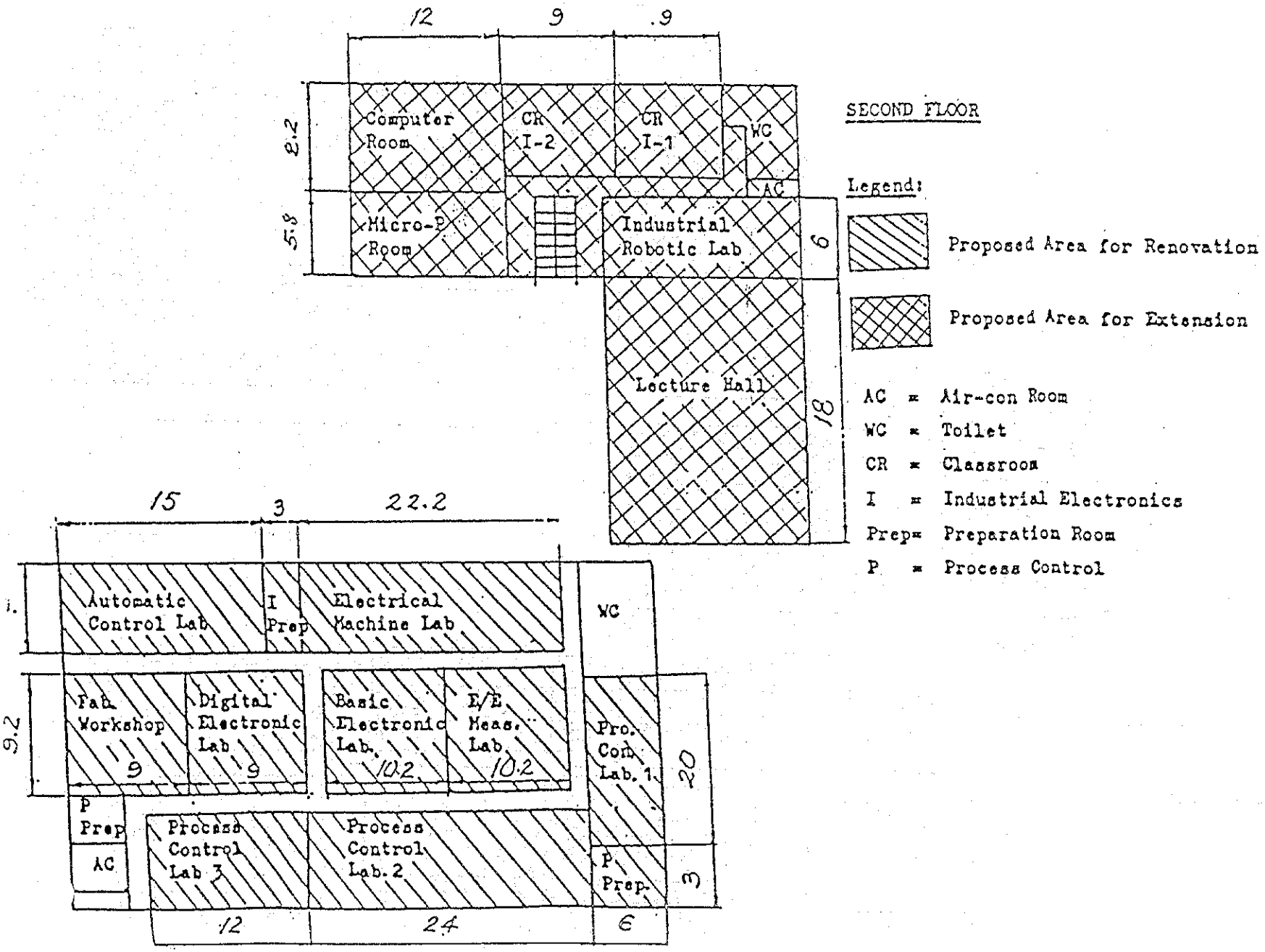
Legend:

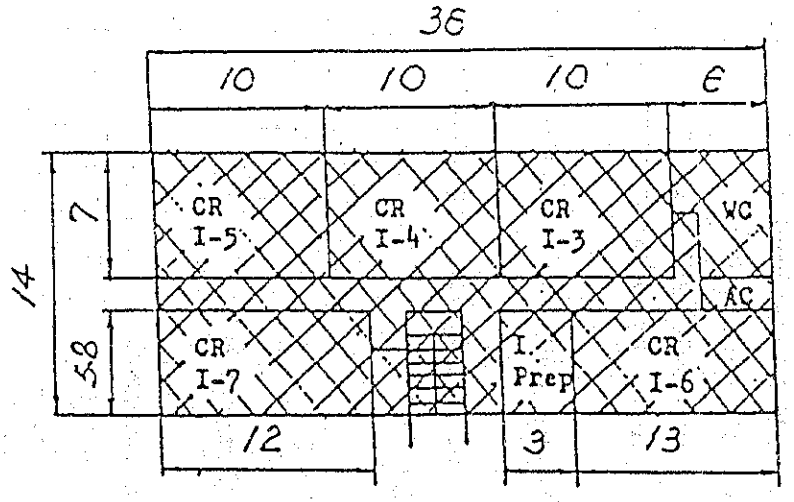
Proposed Area for Renovation

M = Mechatronics
A = Administration




FIRST FLOOR
LL
CR J-2
CR J-1
WC
AC
J Prep
CR J-1
AV Control Room
AV Studio
AV Production
Staff Room
CR P-1
Part Assm. Lab
CR M-3
CR M-2
CR M-1
M Prep
WC
CR P-2
I Drafting Room
Prep
M Drafting Room
Video Imaging System Laboratory
AC
Hydraulic Laboratory
Pneumatic Laboratory
Legend:
Proposed Area for Renovation
Proposed Area for Extension
CR = Classroom
LL = Language Laboratory
AV = Audio Visual
WC = Toilet
Prep = Preparation
J = Japanese Language
M = Mechatronics
I = Industrail Electronics
P = Process Control
* ALL DIMENSION IN METRE


12
9
9
2.2
5.8
Computer Room
CR I-2
CR I-1
WC
AC
Micro-P Room
Industrial Robotic Lab
6
Lecture Hall
18
SECOND FLOOR
Legend:
Proposed Area for Renovation
Proposed Area for Extension
AC = Air-con Room
WC = Toilet
CR = Classroom
I = Industrial Electronics
Prep= Preparation Room
P = Process Control
15
3
22.2
Automatic Control Lab
I Prep
Electrical Machine Lab
WC
9.2
Fab. Workshop
9
Digital Electronic Lab
9
Basic Electronic Lab.
10.2
E/E Meas. Lab
10.2
Pro. Com. Lab. 1
20
P Prep
AC
Process Control Lab 3
Process Control Lab. 2
P Prep.
3
12
24
6



THIRD FLOOR

Proposed Area for Extension

AC = Air-con Room

WC = Toilet

CR = Classroom

Prep = Preparation Room

I = Industrial Electronics

PROPOSED LIST OF MACHINERY AND EQUIPMENT

I Mechatronic Engineering (Electronics-Oriented Mechanical Engineering)

1. Hardware for pneumatics
2. Hardware for hydraulics
3. Hardware for metrology
4. Teaching aid and hardware for service and maintenance training

II Industrial Electronic Engineering

1. Digital electronics experimental equipment
2 Automatic control experimental equipment
3. Microprocessor training and development equipment
4. Computer system with the capability of Computer-Aided Design (CAD)
5. Equipment for robotic training and its application and maintenance
6. Teaching aid and hardware for computer peripheral service and maintenance training

III Processing Control Engineering

1. Single load digital control system
2. Process computer system
3. Programmable logic control system
4. Digital measuring instrument

IV Others

1 Sound proof voice recording booth for language department

PROPOSED CURRICULUM FOR MECHATRONICS ENGINEERING COURSE

1st Year (2000 hours)	2nd Year (2000 hours)
1 Japanese Language	1 Japanese Language
2 Technical English	2 Mathematics
3 Mathematics	3 Industrial Studies II
4 Industrial Studies I	4 Engineering Drawing II
5 Engineering Drawing I	5 Applied Mechanics II
6 Applied Mechanics I	6 CNC Techniques
7 Materials & Processes	7 Maintenance of Machines/ Equipment
8 Workshop Technology & Practice*1	8 Industrial Robotics
9 Electrical Technology	9 Microprocessor
10 Electrical Machines	10 Electronics Engineering II
11 Electronics Engineering I	11 Control Engineering*2
	12 Computer Programming
100%	100%

Note : *1 Workshop Technology & Practice

Theory - 10%

Practice - 19% (15% for machine tool operation and 4% for others such as assembly and repair techniques of apparatus and instruments)

29%

*2 Includes Hydraulic and Pneumatic Control.

PROPOSED SYLLABI FOR JSTIS COURSES

PROPOSED CURRICULUM FOR MECHATRONICS ENGINEERING COURSE

1 Japanese Language

Study of Japanese Grammar, Vocabulary, Pronunciation and Comprehension. Development of skills in written Kanji and Japanese communication composition writing etc.

2 Technical English

Review of the English Grammar, technical report writing and phonetics.

3 Mathematics I

Study of basic mathematical calculations ie BODMAS, Equations, Graphs, Trigonometry, Vector Mathematical Theorems, etc.

4 Industrial Studies I

Study of Industrial Safety, Organisational Set-up, Productivity and Efficiency, Estimating and Costing, Quality Control and Time and Motion study.

5 Engineering Drawing I

Development of skills in Geometrical DRawing, Mechanical Drawing, Electrical & Electronics Symbols drawing, circuit and schematic drawing.

6 Applied Mechanics I

Study of 2 dimensional force system. Analysis of stresses, vectors, forces, moments and couples.

7 Materials and Processes

Study of strength, deformation and structural characteristics of engineering materials including plastics, heat treatment and testing of metals. Development of skills in the use of metallurgical microscope, hardness tester, hardening and tempering furnaces, universal testing machine, impact testing machine, etc.

8 Workshop Technology & Practice*[1]

Study of metrology, cutting theory, welding and machine tool operations. Development of skills in the use of conventional machines and precision measuring machines such as coordinate measuring machines, profile projector, micrometers.

9 Electrical Technology

Study of basic electricity, magnetism, electrostatics, AC principles and circuits including three phase theory and circuits.

10 Electrical Machines

Study of construction, characteristics of AC and DC machines, transformers and special motors ie stepper motors, etc. Development of skills in troubleshooting, maintenance and servicing of AC and DC machines.

11 Electronics Engineering I

STudy of electronic theory; electronics devices construction and characteristics, amplifiers, oscillators, gates. etc.

12 Mathematics II

Study of differentiation, integration, polynomials, matrixes and basic curve fitting.

13 Industrial Studies II

Study of QCC techniques, objectives and policies, organisation, decision-making, operations and marketing, personnel selection and development.

14 Engineering Drawing II

Development of skills in machine designing tool and fixture designs, pneumatic and hydraulic circuit designing.

15 Applied Mechanics II

Study of dynamics, free body diagrams, equilibrium, plane trusses, forces in structures, torsions, friction, types of machine and drives.

16 CNC Techniques

Development of skills in CNC machining, programming, maintenance of CNC machines and quality control of machined parts using co-ordinate measuring machine. Study of CNC and carbide cutting theory.

17 Maintenance of machine/equipment

Development of skills in trouble-shooting, preventive maintenance and fault diagnosis of electrical controlled and microprocessor based machines and equipment. Machine inspection will also be introduced using the latest laser technology.

18 Industrial Robotics

To study the principles and operations of industrial robots.
To develop skills in maintaining and servicing of industrial robotis, including industrial safety in handling of industrial robots.

19 Microprocessor

To study the microprocessor principles, applications, programming languages, architectures, instruction sets, I/O techniques etc.
Development of skills in trouble-shooting and servicing of microprocessor-based system.

20 Electronics Engineering II

To study number systems, logic circuit design and the applications of digital circuits ie encoders, multiplexors, memory etc, development of skills in troubleshooting and servicing of digital circuits.

21 Control Engineering *2

Study of pneumatic and hydraulic principles, circuit designs, functions of various components and troubleshooting. Development of skills in installation and testing of Pneumatic and hydraulic systems. Programmable sequential control techniques will also be introduced.

22 Comouter Programming

To study basic computer programming language (ie BASIC Programming) using microcomputers.
To study advance computer programming using the minicomputers.

PROPOSED CURRICULUM FOR INDUSTRIAL ELECTRONICS ENGINEERING COURSE

1st Year (2000 hours)	2nd Year (2000 hours)
1 Japanese Language	1 Japanese Language
2 Technical English	2 Mathematics
3 Mathematics	3 Industrial Studies II
4 Industrial Studies I	4 Engineering Drawing II
5 Engineering Drawing I	5 Power Electronics
6 Engineering Science	6 Industrial Robotics
7 Electronic Assemby & Fabrication	7 Microprocessor
8 Electrical Technology	8 Computer Programming
9 Electrical Machines	9 Electronics Engineering II
10 Electronic Engineering I	10 Video Imaging Systems
11 Elect/Electronic Measurements	11 Control Engineering I
	12 Control Engineering II
100%	100%

PROPOSED CURRICULUM FOR INDUSTRIAL ELECTRONICS ENGINEERING COURSE

1 Japanese Language

Study of Japanese Grammar, Vocabulary, Pronunciation and Comprehension. Development of skills in written Kanji and Japanese communication composition writing, etc.

2 Technical English

Review of the English Grammar, technical report writing and phonetics.

3 Mathematics I

Study of Basic mathematical calculations ie BODMAS, Equations, Graphs, Trigonometry, Vector Mathematical Theorems, etc.

4 Industrial Studies I

Study of Industrial Safety, Organisational Set-up, Productivity and Efficiency, Estimating and Costing, Quality Control and Time and Motion Study.

5 Engineering Drawing I

Development of skills in Geometrical Drawing, Mechanical Drawing, Electrical & Electronics symbols drawing, circuit and schematic drawing.

6 Engineering Science

Study of mechanics, eg force, torque, motion, friction, work, power, energy, machines, etc, thermodynamics and pressure.

7 Electronic Assembly and Fabrication

Development of skills in proper tools and soldering iron usage techniques, PCB and chasis design and fabrication including wire harnessing, project work.

8 Electrical Technology

Study of basic electricity, magnetism, electrostatics, AC principles and circuits including three phase theory and circuits.

9 Electrical Machines

Study of construction, characteristics of AC and DC machines, transformers and special motors ie stepper motors etc. Development of skills in troubleshooting, maintenance and servicing of AC and DC machines.

10 Electronics Engineering I

Study of electronic theory, electronics devices construction and characteristics, amplifiers, oscillators, gates, etc.

11 Electrical/Electronics Measurement

Study of electrical/electronics measurement theory, to master the operation of various types of electrical/electronics measuring equipment ie, digital multimeter, LCR meter, oscilloscopes, frequency counters, photocorders, X-Y recorder, etc.

12 Mathematics II

Study of differentiation, integration, polynomials, matrixes and basic curve fitting.

13 Industrial Studies II

Study of QCC technique, objectives and policies, organisation, decision-making, operations and marketing, personnel selection and development.

14 Engineering Drawing II

Development of skills in Electrical and Electronic Drawing blueprint reading. Electrical and electronic symbols, circuit and schematic drawing.

15 Power Electronics

To study the principles, construction and applications of electronic triggering devices. To conduct experiments on electronic control circuits for motors and stepper motors etc.

16 Microprocessor

To study the microprocessor principles, application, programming languages, architectures, instruction sets, I/O techniques etc. Development of skills in trouble-shooting and servicing of microprocessor-based system.

17 Electronics Engineering II

To study number systems, logic circuit design and the applications of digital circuits ie encoders, multiplexors, memory etc, development of skills in trouble-shooting and servicing of digital circuits.

18 Video Imaging Systems

Study of principles and applications of CRT data displays, video signals, video circuitry, printers and diskette drives construction. Trouble-shooting and servicing of video display units.

19 Industrial Robotics

To study the principles and operations of industrial robots.
To develop skills in maintaining and servicing of industrial robots, including industrial safety in handling of industrial robots.

20 Computer Programming

To study basic computer programming language (ie BASIC programming) using microcomputers.
To study advance computer programming using the minicomputers.

21 Control Engineering I

Study of pneumatic principles, circuit designs, functions of various components and trouble-shooting.
Development of skills in installation and testing of pneumatic and systems. Programmable sequential control techniques will also be introduced.

22 Control Engineering II

Study of control systems and equipment using electrical and electronic sequential control circuits and also programmable electronic control equipment for lift, conveyor belt control, etc.

PROPOSED CURRICULUM FOR PROCESS CONTROL ENGINEERING COURSE

1st Year (2000 hours)	2nd Year (2000 hours)
1 Japanese Language I	1 Japanese Language II
2 Technical English	2 Industrial Studies I & II
3 Technical Mathematics I & II	3 Engineering Drawing II
4 Engineering Drawing I	4 Microprocessor
5 Physics	5 Computer Programming
6 Workshop Technology & Practice	6 Process Measurement II
7 Electrical Technology	7 Control Principles I & II
8 Electrical Measurements	8 Instrumentation Installation
9 Electronics Engineering	9 Electric & Hydraulic Control
10 Electrical Installation	10 Industrial Instruments
11 Process Measurement I	11 Digital Control System
12 Process Instrumentation I	12 Process Control
	13 Process Instrumentation II
	14 Instrumentation Project
100%	100%

PROPOSED CURRICULUM FOR PROCESS CONTROL ENGINEERING COURSE

1 Japanese Language

Study of Japanese Grammar, Vocabulary, Pronunciation and Comprehension. Development of skills in written Kanji and Japanese communication, composition writing, etc.

2 Technical English

Review of the English Grammar, technical report writing and phonetics.

3 Mathematics I

Study of Basic mathematical calculations ie BODMAS, Equations, Graphs, Trigonometry, Vector Mathematical Theorems, etc.

4 Mathematics II

Study of differentiation, integration, polynomials, matrixes and basic curve fitting.

5 Engineering Drawing I

Development of skills in Geometrical Drawing, Mechanical Drawing, Electrical & Electronics symbols drawing, circuit and schematic drawing.

6 Physics

Study on vectors, forces, Newton's laws, motion, conservation laws of memontum and energy, temperature, heat, change of states, heat transfer, density and pressure, relative humidity.

7 Workshop Technology and Practice

Study on characteristics of engineering metals, mechanical measurement, workshop tools, machine, processes, develop skills in metal fitting, workshop tools, machine usage, arc welding, gas welding.

8 Electrical Technology

Study of basic electricity, magnetism, electrostatics, AC principles and circuits including three phase theory and circuit.

9 Electrical Measurement

Study of electrical/Electronics measurement theory, to master the operation of various types of electrical/electronics measuring equipment ie digital multimeter, LCR meter, oscilloscopes, frequency counters, photocorders, X-Y recorder, etc.

10 Electronics Enginnering I

Study of electronic theory, electronics devices construction and characteristics, amplifiers, oscillators, gates, etc.

11 Electronics Engineering II

To study number systems, logic circuit design and the applications of digital circuits ie encorders, multiplexors, memory, etc, development of skills in trouble-shooting and servicing of digital circuits.

12 Electrical Installation

Study and practice on cable joints, NASA Soldering, IEE Regulations, and British Standards, conduit pipe wiring, electrical installation and theory, project.

13 Process Measurement I

Study on units and standards, accuracy, precision, various instruments used to measure temperature, pressure leve and flow process.

14 Process Instrumentation I

Study on simple feedback control theory, process characteristics control modes, control valves, classification of hazardous locations, pneumatic process instruments, electronic process instruments.

15 Industrial Studies I

Study of Industrial Safety, Organisational Set-up, Productivity and Efficiency, Estimating and Costing, Quality Control and Time and Motion Study.

16 Industrial STudies II

Study of QCC technique, objectives and policies, organisation, decision-making, operations and marketing, personnel selection and development.

17 Engineering DrawingII

Develop skills in blueprint reading and instrumentation drawing, instruction symbols, process flow sheet, loop drawing, hook-up drawing, panel drawing.

18 Microprocessor

To study the microprocessor principles, applications, programming languages, architectures, instruction sets, I/O techniques, etc Development of skills in trouble-shooting and servicing of micro-processor-based system.

19 Computer Programming

To study basic computer programming language (in BASIC programming) using microcomputers.
To study advance computer programming using the minicomputers.

20 Process Measurements II

Study on the principles of analytical measurements, pH, conductivity, liquid density, viscosity, humidity, liquid and gas analysis.

21 Control Principles

Study on the principles of control system, Laplace Transforms used in formulation of block diagrams and transfer function. Transient responses and frequency responses, characteristics of feedback control system, system stability, treatment of Nyquist criteria, Bode diagram and Nichols diagram method in system evaluation, sequential control, diagrams, devices, time chart.

22 Instrumentation Installation

Develop skills in instrumentation piping and instruments installation, air supply piping, air signal piping, conduit wiring, panel wiring, instrument installation.

23 Electrical & Hydraulic Control

Study on principles and elements of electric and hydraulic control. Electrical final control element, solenoid valve, motor valve, hydraulic control, fluid power, hydraulic system, oil pump, hydraulic circuit diagrams. Maintenance of equipments.

24 Industrial Instruments

Study and development of skills in maintenance, servicing repairs, diagnosis of process instruments. Pneumatic instruments, transmitters, recorders, indicators, controllers, integrator, positioner, computer, auxilliary equipments, pneumatic control valves, types, construction sizing and selection of materials, actuator, regulators. Electronic Equipments, I series equipments, ER recorders transmitter, logic control devices,
Digital control equipments, controllers, indicators, barriers programmers.

25 Digital Control Systems

Study and development of skills in maintenance, service repairs, diagnosis of digital process control systems.
Computer Systems and concepts, process computer, computer control, signal conditioning, communication I/O Interface, microprocessors (16 bit).
Distributed Control Systems, programming, batch/blending control.

26 Process Control

Study and practice on the characteristics of process control, process control of temperature, level, flow and pressure, batch control, ratio control, cascade control, auto selector control, feed forward control, digital blending and batch systems.

27 Process Instrumentation II

Study on the principles of process equipments, compressors, plant processes, boiler control, petro chemical plant, oil refineries, water treatment. Industrial visits.

28 Instrumentation Project

The project will integrate the studies and skills developed in the whole curriculum.

SHORT-TERM EXPERTS' ASSIGNMENT SCHEDULE

	Short-Term Experts for	Duration in Expert Months					
		1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
	Mechatronics Engineering						
* M-1	CNC Programming, Machining and Industrial Robotics, etc.	6	-	-	6	-	12
M-2	NC Trouble-shooting, Fault-diagnosis, Repair, etc	-	12	-	6	-	18
M-3	Pneumatics	6	-	-	6	-	12
M-4	Hydraulics	6	-	-	6	-	12
M-5	Machine Inspection, Maintenance Trouble-shooting, Repair, Scraping, etc	12	-	6	-	-	18
M-6	Metrology (Co-ordinate measuring machine, laser Interferometer,etc)	-	6	-	-	-	6
M-7	Heat Treatment, Material Testing, etc	-	6	-	-	-	6
	Sub-Total:						84
	Industrial Electronic Engineering						
I-1	Industrial Robotic Operations, programming. Repair and Maintenance including Sensor Technology, etc.	12	-	6	-	3	21
I-2	Computer Programming in BASIC, FORTRAN, COBOL, PASCAL, etc (1st year) and CAD (2nd year)	6	-	6 (CAD)	-	3 (CAD)	15
I-3	Microprocessor Principles, Trouble-Shooting and servicing of microprocessor based and Digital Electronics equipment.	6	-	6	-	3	15
I-4	Sequential Automatic Control using electrical, electronics, designs, applications, trouble-shooting, etc.	-	6	-	6	-	12
I-5	Computer Peripherals trouble-shooting, servicing, calibration and maintenance	-	6	-	6	-	12
I-6	Microprocessor Development System	-	6	-	6	-	12
	Sub-Total:						87

	Short-Term Experts for	Duration in Expert Mont					
		1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Tota
	Process Control Engineering						
P-1	Distributed Control System	2	-	-	-	-	2
P-2	Analytical Instruments	-	2	-	-	-	2
P-3	Single Loop Digital Control System	-	2	-	-	-	2
P-4	Digital Batch/Blending Control System and Microprocessor based control system	-	-	2	-	-	2
P-5	Practical Applications of Control System	-	-	2	-	-	2
	Sub-Total:						10
	Japanese Language						
J-1	Japanese language	3	-	-	3	-	6

Total Expert Months = 187

* M - Mechatronics

I - Industrial Electronics

P - Process Control

J - Japanese Language

Specialised Discipline	First Year	Second Year		Third Year		Fourth Yr	Counterpart Months
		1st Half	2nd Half	1st Half	2nd Half		
M1. CNC Programming, machining, etc.	1X3mth	1X3mth	1X3mth				9
M2. Pneumatics	1X3mth	1X3mth	1X3mth				9
M3. Hydraulics	1X3mth	1X3mth	1X3mth				9
M4. Metrology, Coordinate measuring, laser interferometer measuring and other precision computer aided measuring	1X3mth	1X3mth	1X3mth				9
M5. Machine repairing, trouble-shooting, scraping, inspection etc	1X6mth	1X6mth					12
M6. CNC trouble-shooting, fault-diagnosis, repair, etc.				1X12mth		1X12mth	24
M7. Heat-treatment, and material testing.		1X3mth					3
M8. Industrial automation, automatic controls, etc.				1X6mth		1X6mth	12
						Subtotal :	87
I1. Industrial robotics	1X3mth	1X3mth	1X3mth	1X3mth			12
I2. Computer peripherals (VDU, printers, plotters, disk-drives, etc	1X3mth	1X3mth	1X3mth	1X3mth	1X3mth		15
I3. Sequential automatic control	1X3mth	1X3mth	1X3mth	1X3mth			12
I4. Computer programming, system management, system trouble-shooting, etc	1X3mth	1X3mth	1X3mth	1X3mth	1X3mth		15
I5. Microprocessor-based equipment trouble-shooting, repair, etc.	1X3mth	1X3mth	1X3mth	1X3mth	1X3mth		15
I6. Low-cost automation	1X3mth	1X3mth	1X3mth	1X3mth	1X3mth		15
I7. Industrial Electronics Engineering Course at IVT. (Institute of Vocational Training)	1X12mth						12
						Sub-total :	96
P1. Digital Control System (Distributed controls, Batch/Blend Analytical instruments, etc.	1X3mth	3X3mth	2X3mth	2X3mth	2X3mth		30
J1. Japanese Language		1X3mth	1X3mth	1X3mth			9
A1. Audio/Visual Equipment maintenance Audio/Visual Production	1X3mth		1X3mth				6
						Grand-Total	228

*M-Mechatronics I-Industrial ctronics P-Process Control J-Jap ese Language
A-Audio/Visual