(2) 電源

工学部本館の 変圧設備から各階及び各実験棟の主分電盤を通して各部屋に配電されている。機材計画に当たって採用する電気方式は以下の通りとする。

三相 : 380V ± 10%
単相 : 220V ± 10%
周波数 : 50Hz

停電は季節により一週間に 1度の割合で発生するので、停電対策の必要な機材には無停電装置を計画に入れる。

電圧の変動は、ほぼ±10%に収まっているが、± 5%の精度を必要とする機材には自動電圧調整器を組み込む。

(3) 給水

実験機材に使用する水は、ﾗﾝｼﾞｯﾄｷｬﾝﾊﾟｽ内の深井戸からの給水を利用する。

(4) ｶﾞｽ類

実験に必要な酸素、窒素、 2酸化炭素、ｱﾙｺﾞﾝｶﾞｽ等は国内で供給可能であり、輸入の必要はない。

4.3 基本計画

4.3.1 機材計画

前出「3.3.3 機材の概要」及び「4.1 機材の設計方針」に基づいて設計した各学科の機材ﾘｽﾄを以下に示す。

なお、備考欄に能力、容量等の数値が示されているものは、全て参考までに記載されたものであり、おおよその数値を示したものである。

(1) 電気工学科

1) 電気機器実験室

項目No.	機 材 名	数量	備 考
2.1.1	3相篭型誘導電動機実験ｾｯﾄ	1	篭型誘導電動機：1 KW 極数切換誘導電動機：1 KW
2.1.2	3相巻線型誘導電動機実験ｾｯﾄ	1	ｽﾘｯﾌﾟﾘﾝｸﾞ付き誘導電動機：1 KW
2.1.3	直流電動機実験ｾｯﾄ	1	複巻直流電動機：0.75 KW 直巻直流電動機：1 KW
2.1.4	直流発電機実験ｾｯﾄ	1	分巻直流発電機：1 KW 分巻直流発電機(ﾀｺﾒｰﾀ付き)：800 W
2.1.5	単相ﾓｰﾀｰ実験装置	1	誘導電動機(ﾗﾝﾆﾝｸﾞ容量付き)：1 KW 誘導電動機(起動及びﾗﾝﾆﾝｸﾞ容量付き)：1 KW
2.1.6	3相同期電動機実験ｾｯﾄ	1	ﾎﾟｰﾙﾛｰﾀ付き同期電動機：1 KW 無励磁同期電動機
2.1.7	3相同期発電機実験ｾｯﾄ	1	ﾎﾟｰﾙﾛｰﾀ付き同期発電機：1 KVA 無励磁同期発電機
2.1.8	変圧器実験ｾｯﾄ	1	単相変圧器：250 VA 3相変圧器：300 VA
2.1.10	ﾊﾟﾜｰｴﾚｸﾄﾛﾆｸｽ実験ｾｯﾄ	1	ｺﾝﾊﾞｰﾀ/ｲﾝﾊﾞｰﾀ：入力：50 Hz、3相 出力：0.5～400 Hz SSR(直流用)、調整範囲：直流4～200 V, 10 A SSR(交流用)、3相交流：75～264 V, 8 A(1.5 KWﾓｰﾀ)
2.1.11	配線材料工具一式	1	耐熱ﾋﾞﾆｰﾙ線、各種ﾒｰﾀ類

2) 電子工学実験室

項目No.	機 材 名	数量	備 考
2.2.1	IC 設計ﾊﾟｯｹｰｼﾞｿﾌﾄ	1	IC設計用（各ｽﾃｯﾌﾟ、ﾊﾟｿｺﾝ/ﾜｰｸｽﾃｰｼｮﾝ用）
2.2.2	回路ｼｭﾐﾚｰｼｮﾝﾊﾟｯｹｰｼﾞｿﾌﾄ	1	時間領域回路解析用 VDHLﾃﾞｼﾞﾀﾙ回路解析用(ﾊﾟｿｺﾝ用)
2.2.3	PCB 設計装置（含ｿﾌﾄ）	5	PCBﾚｲｱｳﾄ、設計用(ﾊﾟｿｺﾝ用)

項目No.	機　材　名	数量	備　　考
2.2.4	PCB 試作装置	1	ﾌﾟﾛﾄｺﾙﾀｲﾌﾟPCB製作用 ｺﾝﾄﾛｰﾙ装置(ﾊﾟｿｺﾝ及びｿﾌﾄｳｪｱ)
2.2.5	半田装置	1	ﾁｯﾌﾟ取付、取り外し用
2.2.6	ﾌﾟﾛｯﾀｰ	1	A1ｻｲｽﾞ、ﾍﾟﾝ書き
2.2.7	LSI及び付属部品	1	ﾏｲｸﾛﾌﾟﾛｾｯｻｰﾁｯﾌﾟ、ﾌﾟｽｶｰﾄﾞﾌﾚｰﾑ、 ｾﾝｻｰ、IC、同付属品、PCB製作材料
2.2.8	ﾃﾞｼﾞﾀﾙｽﾄﾚｰｼﾞｵｯｼﾛ	4	帯域：100 MHz ﾁｬﾝﾈﾙ数：4
2.2.9	ﾌｧﾝｸｼｮﾝｼﾞﾈﾚｰﾀ	2	周波数範囲：1～50 MHz 出力波形：正弦、方形、三角、ﾗﾝﾌﾟ、ﾊﾟﾙｽ
2.2.10	ﾛｼﾞｯｸｱﾅﾗｲｻﾞｰ	1	ﾀｲﾐﾝｸﾞ解析；ｸﾛｯｸ：Max 200 MHz, 16ﾁｬﾝﾈﾙ ｽﾃｰﾄ解析；外部ｸﾛｯｸ　：40 MHz 以下 入力ﾁｬﾝﾈﾙ：48ﾁｬﾝﾈﾙ
2.2.11	ﾃﾞｰﾀｼﾞﾈﾚｰﾀ	1	周波数範囲：0.1μHz～100 KHz 波形：正弦、方形、三角、鋸歯、任意

3)　　通信工学実験室

項目No.	機　材　名	数量	備　　考
2.3.1	標準信号発生器	1	周波数範囲：100 KHz～2 GHZ 変調：AM.FM、精度：±1 dB
2.3.2	RF ﾍﾞｸﾀｰﾈｯﾄﾜｰｸｱﾅﾗｲｻﾞｰ	1	周波数範囲：300 KHz～3 GHz 解像度：1 Hz、出力範囲：+5 dBm～-18 dBm
2.3.4	周波数ｶｳﾝﾀｰ	1	周波数範囲：60 KHz～3 GHz ｶｳﾝﾃｨﾝｸﾞﾀｲﾑ：<10 m 秒<0.1 秒<1秒<10 秒<100 秒 ﾃﾞｼﾞﾀﾙ表示：9 桁
2.3.5	高周波ｱﾅﾛｸﾞ設計ﾊﾟｯｹｰｼﾞｿﾌﾄ	1	線形・非線形解析 ﾗｲﾌﾞﾗﾘｰ：S ﾊﾟﾗﾒｰﾀ等
2.3.6	EMC 計測装置	1	ｽﾍﾟｸﾄﾙ分析機、ﾌﾟﾚｾﾚｸﾀｰ、ｲﾝﾋﾟｰﾀﾞﾝｽ安定回路網 標準ｱﾝﾃﾅ、ﾌﾟﾛｯﾀｰ
2.3.9	ﾋﾞｯﾄｴﾗｰﾚｰﾄｱﾅﾗｲｻﾞｰ	1	ｲﾝﾀｰﾌｪｲｽ：RS-232-C/V-24, V-35, 1 SDN ﾃﾞｰﾀﾚｰﾄ：最大 64 Kbps

4)　　計測制御実験室

項目No.	機　材　名	数量	備　　考
2.4.1	ﾌﾟﾛｾｽ制御実験ｾｯﾄ	1	圧力、温度、流量、液面の計測・制御用 ﾀﾝｸ、計測・制御機器
2.4.2	作業ﾛﾎﾞｯﾄ実験ｾｯﾄ	1	5軸、電気ｻｰﾎﾞ駆動 繰り返し位置決め精度：0.3 mm
2.4.3	DSP ﾎﾞｰﾄﾞ	2	
2.4.4	A/D 等ﾎﾞｰﾄﾞ類	1	ｱﾅﾛｸﾞ I/O ｶｰﾄﾞ 32 ﾁｬﾝﾈﾙﾃﾞｼﾞﾀﾙ I/O ｶｰﾄﾞ 等
2.4.5	DSP 用ﾊﾟｯｹｰｼﾞｿﾌﾄ	1	時間／周波数ﾄﾞﾒｲﾝ解析、ﾃﾞｼﾞﾀﾙﾌｨﾙﾀｰ設計 ﾘｱﾙﾀｲﾑｽﾍﾟｸﾄﾙ解析、ﾃﾞｼﾞﾀﾙ記録
2.4.6	任意関数波形発生器	1	ｱﾅﾛｸﾞﾁｬﾝﾈﾙ数：2 ﾌﾟﾛｸﾞﾗﾑ生成機能、ｸﾞﾗﾌｨｯｸ波形ﾌﾟﾛｸﾞﾗﾐﾝｸﾞ ｲﾝﾀｰﾌｪｲｽ：GPIB
2.4.7	FFT ｱﾅﾗｲｻﾞｰ	1	入力ﾁｬﾝﾈﾙ数：2　周波数範囲：10 MHz～100 KHz ｻｰﾎﾞ解析ﾓｰﾄﾞ、ｽﾍﾟｸﾄﾙ計測ﾓｰﾄﾞ、波形計測ﾓｰﾄﾞ ｲﾝﾀｰﾌｪｲｽ：GPIB

(2)　産業工学科

1)　CNC 実験室

項目No.	機　材　名	数量	備　考
3.1.3	CNC ﾀｰﾆﾝｸﾞｾﾝﾀｰ	1	標準加工径：160 mm、 最大加工長：500 mm、 主軸駆動ﾓｰﾀ 7.5/5.5 KW、 工具取付ｽﾃｰｼｮﾝ10
3.1.4	CNC ﾜｲﾔ放電加工機	1	ﾄﾗﾊﾞｰｽ長：360 x 250 x 220 mm、 ﾜｲﾔ速度：50～360 mm/秒
3.1.8	CNC 立型ﾏｼﾆﾝｸﾞｾﾝﾀｰ	1	ﾃｰﾌﾞﾙ寸法：900 x 450 mm、主軸駆動ﾓｰﾀ 7.5/5.5 KW、 主軸端形式 40 T

2)　CAD/CAM 実験室

項目No.	機　材　名	数量	備　考
3.2	CAD/CAMｼｽﾃﾑ	1 ｾｯﾄ	
	(ﾊｰﾄﾞｳｪｱ)		
	・ﾜｰｸｽﾃｰｼｮﾝ	2	主ﾒﾓﾘｰ：64 MB、 1.44 MB ﾌﾛｯﾋﾟｰﾃﾞｨｽｸ駆動、 1 GB ﾊｰﾄﾞﾃﾞｨｽｸ駆動、19"ｶﾗｰ ﾓﾆﾀｰ、ｷｰﾎﾞｰﾄﾞ及びﾏｳｽ
	・ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀ	6	CPU：486、 50 MHz、 ﾒﾓﾘｰ：16 MB、 1.44 MB ﾌﾛｯﾋﾟｰﾃﾞｨｽｸ駆動、120 MB ﾊｰﾄﾞﾃﾞｨｽｸ駆動、 20"ｶﾗｰﾓﾆﾀｰ(VGA付)、ｷｰﾎﾞｰﾄﾞ及びﾏｳｽ
	・ﾌﾟﾛｯﾀｰ	1	A0、 ﾍﾟﾝ･ﾍﾟﾝｼﾙﾌﾟﾛｯﾃｨﾝｸﾞ
	・ﾃｰﾌﾟﾄﾞﾗｲﾌﾞ	1	150 MB ｶｰﾄﾘｯｼﾞﾃｰﾌﾟ駆動
	・CD Rom ﾄﾞﾗｲﾌﾞ	1	
	・ﾈｯﾄﾜｰｸ用装置	1	ｼｽﾃﾑﾈｯﾄﾜｰｸ構成用、ｿﾌﾄｳｪｱ付
	・ﾚｰｻﾞｰﾌﾟﾘﾝﾀｰ	1	A3
	(ｿﾌﾄｳｪｱ)		
	・CAD/CAM ｿﾌﾄｳｪｱ(ﾜｰｸｽﾃｰｼｮﾝ対応)	1	基本ｿﾌﾄ、 3次元ﾓﾃﾞﾙ、ｿﾘｯﾄﾞﾓﾃﾞﾙ、ﾘﾝｸ機構、 ﾄﾞﾗﾌﾃｨﾝｸﾞ、NC(旋盤、ﾐﾙ)、ﾗｲﾌﾞﾗﾘｰ、ﾛﾎﾞﾃｨｯｸｽ、 有限要素ﾓﾃﾞﾘﾝｸﾞ、ｲﾝﾀｰﾌｪｲｽ
	・CAD/CAM ｿﾌﾄｳｪｱ (ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀ対応)	6	基本ｿﾌﾄ、ﾄﾞﾗﾌﾃｨﾝｸﾞ、ｲﾝﾀｰﾌｪｲｽ、NCﾌﾟﾛｸﾞﾗﾑ

3)　精密計測実験室

項目No.	機　材　名	数量	備　考
3.3.1	・ﾃﾞｰﾀﾌﾟﾛｾｯｻ	1	ﾃﾞｰﾀ入力：4ﾁｬﾝﾈﾙ、登録部品数：32、 最大登録項目数：26/部品、9"CRT、ﾌﾟﾘﾝﾀｰ
	・ﾃﾞｼﾞﾀﾙ計測器	1	工具顕微鏡、ﾍﾞﾝﾁﾏｲｸﾛﾒｰﾀ、ｲﾝｼﾞｹｰﾀ、ﾉｷﾞｽ、 各種ﾏｲｸﾛﾒｰﾀ(外側、内側、ねじ、歯車等)ﾊｲﾄﾏｽﾀｰ
3.3.4	真円度測定機	1	最大測定径：280 mm、最大測定高さ：外径220 mm、 内径：100 mm、最大質量：10 Kg

(3)　土木工学科

項目No.	機材名	数量	備考
4.1	構造物試験装置	1	静的ｼﾞｬｯｷ加重能力：500 tf、 動的ｼﾞｬｯｷ加重能力： 50 tf、 中空ｼﾞｬｯｷ加重能力： 10 tf、 自立式鋼製ﾌﾚｰﾑ（梁）：4m(L)x400mm(W)、300 ft-m
4.5	万能試験機	1	手動式、最大加重：50 tf 標準ｸﾞﾘｯﾌﾟ一式

(4)　機械工学科

項目No.	機材名	数量	備考
5.1	渦電流式動力計	1	吸収馬力：100PS、 回転数 2,800～8,500 r.p.m.
5.2	排気ｶﾞｽ分析計 （ﾃﾞｰﾀ収集処理装置付き）	1	可搬型、Co、Co2、So2、No2、O2分析用、 ﾃﾞｰﾀ処理装置付
5.3	ﾃﾞｨｰｾﾞﾙ燃料噴射ﾎﾟﾝﾌﾟﾃｽﾀｰ	1	ｼﾘﾝﾀﾞｰ：12、回転数 50～3,500 r.p.m.
5.4	内燃機関試験装置	1	ﾃﾞｨｰｾﾞﾙｴﾝｼﾞﾝ：4 ｼﾘﾝﾀﾞｰ、90PS、 過電流式動力計：100PS
5.5	ｽﾁｰﾑﾊﾟﾜｰﾌﾟﾗﾝﾄ実験装置	1	ﾎﾞｲﾗｰ容量：180Kg/hr、ﾀｰﾋﾞﾝ出力：1KW、 燃料：LNG、ﾃﾞｰﾀ収集ｼｽﾃﾑ付
5.6	ｶﾞｽﾀｰﾋﾞﾝﾌﾟﾗﾝﾄ実験装置	1	2軸ｶﾞｽﾀｰﾋﾞﾝ、最高出力 約 4KW、ﾃﾞｰﾀ収集ｼｽﾃﾑ付
5.7	空圧油圧式制御ｼｽﾃﾑ実験装置	1	制御変量：流量、液面、ﾀﾝｸ内圧力、ﾀﾝｸ内温度

(5)　化学工学科

(Group 1)

1) 化学工学実験

項目No.	機材名	数量	備考
6.1.1	上下動式液々向流抽出装置	1	抽出塔：50φ x 1000mm(2塔)、ﾃﾞｨｽｸ数30/塔 ｾﾄﾗｰ、ﾚｼｰﾊﾞｰ、ﾌｨｰﾄﾞﾎﾟﾝﾌﾟ(4基)
6.1.4	棚段塔連続蒸留装置	1	蒸留塔：32mmφ、10段(2塔)、5段(2塔) 連続式、制御ｺﾝﾄﾛｰﾙ
6.1.7	ﾌｧｰﾒﾝﾀｰｼｽﾃﾑ （撹拌液相反応装置）	1	反応相容量：2.5 L、ｶﾞﾗｽ製ﾀﾝｸ、 制御装置(pH,DO,温度、撹拌、防泡)、ﾏｲｸﾛﾁｭｰﾌﾞﾎﾟﾝﾌﾟ
6.1.8	流動層ﾘｱｸﾀｰ	1	ﾘｱｸﾀｰ容量：2 L、制御装置(pH,温度) ﾏｲｸﾛﾁｭｰﾌﾞﾎﾟﾝﾌﾟ
6.1.9	固定層ﾘｱｸﾀｰ	1	ﾘｱｸﾀｰ容量：2 L、ｶﾞﾗｽ製ﾀﾝｸ、 制御装置(pH,ﾚﾍﾞﾙ、温度)、ｴｱﾚｰｼｮﾝﾎﾟﾝﾌﾟ
6.1.10	撹拌機ｾｯﾄ	3	回転数(r.p.m.)：A 20～1,200、 B 10～600、 C 5～300、 制御装置（ﾄﾙｸ、回転数）
6.1.11	ﾄﾞﾗﾑ乾燥機	1	ﾄﾞﾗﾑ：315φ x 350mm 設計蒸気圧力：8 Kg/cm2
6.1.12	ﾎﾞｰﾙﾐﾙ一式	1	2ﾗｲﾝ方式(2ｾｯﾄ)、回転数：170～340 r.p.m. ﾀｺﾒｰﾀ、ｽﾃﾝﾚｽﾎﾟｯﾄ、磁器ﾎﾟｯﾄ、HDｱﾙﾐﾅﾎﾞｰﾙ、ふるい 超音波洗浄機

2) 分析化学実験

項目No.	機 材 名	数量	備 考
6.1.13	分析化学実験用ｶﾞﾗｽ器具一式	1 ｾｯﾄ	ﾃﾞｼｹｰﾀ、ﾋﾞｭﾚｯﾄ、ﾋﾟﾍﾟｯﾄ、ﾌﾗｽｺ、ﾋﾞｰｶｰ、試薬瓶、温度計など (60人分)

3) 有機化学実験

項目No.	機 材 名		備 考
6.1.14	有機化学実験用ｶﾞﾗｽ器具一式	1 ｾｯﾄ	ｽﾁﾙﾍｯﾄﾞ、ｺﾝﾃﾞﾝｻｰ、ｶﾗﾑ、ﾊﾟｯｷﾝｸﾞ、ﾌﾗｽｺ、ﾁｭｰﾌﾞ、ﾌｧﾝﾈﾙなど (60人分)

(Group II)

分析機器

項目No.	機 材 名	数量	備 考
6.2.4	走査型電子顕微鏡	1	倍率：150～200,000、解像度 4.5mm (30KV,WD=8mm) ﾎﾟﾗﾛｲﾄﾞｶﾒﾗ、ｲﾒｰｼﾞﾌﾟﾘﾝﾀｰ、ｻﾝﾌﾟﾙ準備設備
6.2.5	紫外－可視分光光度計	1	波長範囲：190～900 mm、解像度 0.15 mm、 ﾃﾞｰﾀ処理装置、表面分析用ｱｸｾｻﾘｰなど
6.2.7	ｶﾞｽｸﾛﾏﾄｸﾞﾗﾌ	1	ｲﾝｼﾞｪｸｼｮﾝﾕﾆｯﾄ：ｽﾌﾟﾘｯﾄ／ｽﾌﾟﾘｯﾄﾚｽ、 ﾃﾞｨﾚｸﾀｰ：FIDﾓﾃﾞﾙ及びTCOﾓﾃﾞﾙ、ﾃﾞｰﾀ処理装置
6.2.8	熱分析装置	1	示差熱量計（走査型）、熱重量分析計、 示差熱分析計、熱歪計、 ｼｽﾃﾑ制御装置(ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀを含む)
6.2.10	ﾌｰﾘｴ変換赤外分光光度計	1	光学系：ｼﾝｸﾞﾙﾋﾞｰﾑ方式 波数範囲：4,600/cm～400/cm 分解能力：2 cm-1, 4 cm-1, 8 cm-1, 16 cm-1 ﾃﾞｰﾀｻﾝﾌﾟﾘﾝｸﾞ：He-Ne ﾚｰｻﾞｰ使用

(6) **コンピューター**

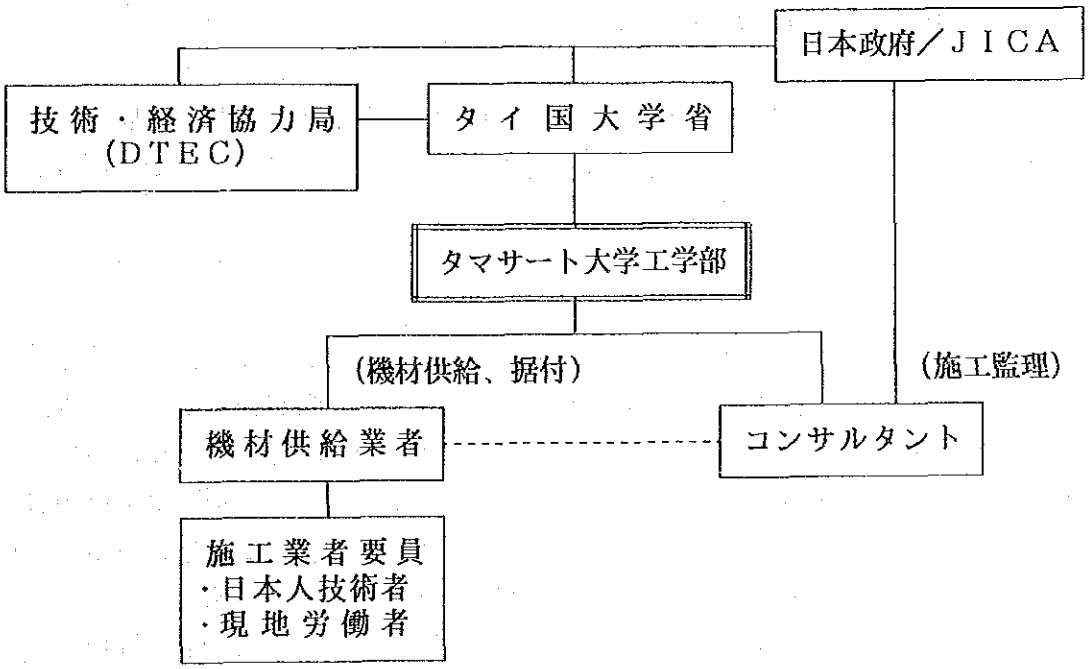
項目No.	機 材 名	数量	備 考
7.1	ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀｰ（電子工学科）	5	CPU：486、ｸﾛｯｸ：66 MHz　RAM：16 MB ﾌﾛｯﾋﾟｰﾃﾞｨｽｸ駆動：5", 1.2 MB x 2
7.2	ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀｰ（機械工学科）	2	ﾊｰﾄﾞﾃﾞｨｽｸ駆動：200 MB ﾃﾞｨｽﾌﾟﾚｰ：1.7"　ﾚｰｻﾞｰﾌﾟﾘﾝﾀｰ(A4)
7.3	ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀｰ（化学工学科）	2	ｿﾌﾄｳｪｱ：MS-DOS MS-WINDOWS

4.4 施工計画

4.4.1 施工方針

本計画は、ﾀｲ国側が負担措置する建物・設備の工事部分と日本国政府の無償資金協力による機材の調達部分から成る。本計画の実施機関である ﾀﾏｻｰﾄ大学工学部は日本国の ｺﾝｻﾙﾀﾝﾄと契約し、詳細設計、入札図書作成、入札審査、機材の据付工事の施工監理等を代行させる。なお、施工実施にあたっての実施体制は図 4.4.1のとおりである。

図 4.4.1 施工実施体制



4.4.2 施工上の留意事項

機材の配備に当たっては、本基本設計で選定した機材の能力を確保すること、適切な設置状況を確保することが必要である。

ﾀﾏｻｰﾄ大学工学部の建屋は、新設されたばかりであり、各機材を設置するためのｽﾍﾟｰｽ、ﾕｰﾃｨﾘﾃｨｰ共に充分な余裕がある。したがって、本ﾌﾟﾛｼﾞｪｸﾄで供与される機材は重量のあるものを除き、自由に配置することが可能である。しかし、本計画で整備予定の機材は量、金額ともに同工学部の中に大きなｼｪｱを占めるので、将来乱雑で活動しにくい実験室とならないよう長期的視野に立った配置計画を立てる必要がある。

本計画で計画された機材には、一つのﾒｰｶｰで対処できない、あるいは新規に図面を起こす必要のある特注の機材も存在する。したがって、施工にあたってはｻﾌﾟﾗｲﾔｰとの充分な仕様打ち合わせが必要である。

要請機材の現地における据付及び運転の指導員の派遣に関しては、無駄な待ち時間を無くし効率良く行えるよう適切な派遣時期を選定するよう留意する必要がある。

4.4.3 施工監理計画

日本政府無償資金協力の方針及び ｺﾝｻﾙﾀﾝﾄ契約に基づき、基本設計の主旨を踏まえ、ｺﾝｻﾙﾀﾝﾄ は実施設計及び監理業務について、一貫したﾌﾟﾛｼﾞｪｸﾄ遂行 ﾁｰﾑを組み、業務完了まで遅滞なく本計画を遂行させなければならない。施工監理段階においては、必要に応じ、機材製作図の承認、工場完成 ﾃｽﾄの立会い、現地据付時の立会い指導、及び引渡し時の検査に技術者を適宜出張させ、施工を円滑に進める必要がある。それとともにｺﾝｻﾙﾀﾝﾄ はﾀｲ国側負担工事が機材を受入れるのに支障なく進行しているか否かを把握し、遅れがみられる場合には、随時ﾀｲ国側に必要な処置について勧告し、全体として計画遂行を監理する必要がある。

4.4.4 機材調達計画

(1) 調達方法

計画機材の調達は、機材供給業者（商社）の競争入札をとおした一括請負契約によるものとする。機材は原則として日本製品を調達対象とするが、一部の機材については第三国製品も対象に含めることも考慮する。また、ﾊﾟｰｿﾅﾙｺﾝﾋﾟｭｰﾀｰは現地に

おいて容易に入手でき、納入後のﾒﾝﾃﾅﾝｽ及びﾄﾚｰﾆﾝｸﾞ等のｻｰﾋﾞｽ体制もを考慮すると、現地調達とする可能性がある。

(2) 輸送方法

計画機材は、原則として製造地の最寄りの港より一括して、あるいは分割して船積みし、ﾊﾞﾝｺｸ(ｸﾛﾝﾄｲ)港で陸揚げする。ｸﾛﾝﾄｲより ﾗﾝｼｯﾄｷｬﾝﾊﾟｽまでは道路輸送する。

4.4.5 事業負担区分

(1) 日本国側負担業務

1) 機材の調達及びそれに伴う現地への輸送、搬入、据付工事
2) 現場における機材からｺﾝｾﾝﾄまでの配線工事（但し、ｺﾝｾﾝﾄは機械のそばに設置されるものとし、ｺﾝｾﾝﾄ迄の配線工事はﾀｲ国側が行うものとする。）
3) 試運転調整、運転及びﾒﾝﾃﾅﾝｽの指導
4) 入札図書作成、入札及び施工監理にかかるｺﾝｻﾙﾃｨﾝｸﾞ業務

(2) ﾀｲ国側負担業務

1) 機材設置予定建物の内装工事、機械基礎工事、既存機材の移設工事
2) 受変電、配線工事
3) 用排水工事、ｶﾞｽ管工事
4) 照明工事
5) 空調設備工事
6) ﾄﾞﾗﾌﾄ、換気工事
7) 電話通信設備工事
8) 什器、備品類調達
9) 薬品、消耗品類調達
10) 計画機材の輸入に関する陸揚げ、通関、国内輸送に関する許認可手続き及びそれ等に係る費用の負担
11) 施工に必要な認可等の手続き

12) 日本公認の外国為替銀行に対する銀行取極手数料の支払
13) ﾀｲ国での、本計画関連業務による日本人の出入国、滞在のための手続き上の便宜
14) 無償資金協力による機材の適切かつ効果的運用管理
15) その他無償資金協力に含まれない全ての経費の負担

4.4.6 実施工程

本計画を日本の無償資金協力により実施する場合、概略次の段階で進行する。

(1) 実施設計（詳細設計）

基本設計報告書をもとに、整備機材の詳細仕様を決定するとともに、入札図書を作成し、関係機関の了承を得た後、入札を実施し、評価の上、契約、発注する。この間約 3ヶ月を要する。

(2) 製作及び工事の実施

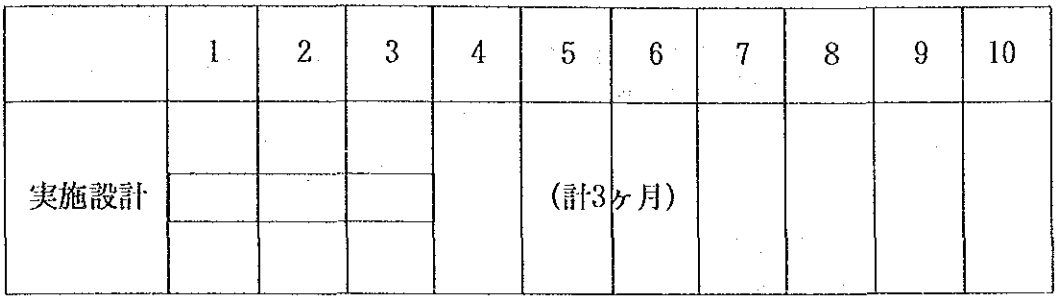
受注業者は、承認用図書、製作用図書の作成、機材の製作、船積みを行い、ﾀｲ国へ機材を出荷する。受注業者は現地での試運転完了まで、すべての現地作業（陸揚げ、通関、内陸輸送、据付工事）を実施する。

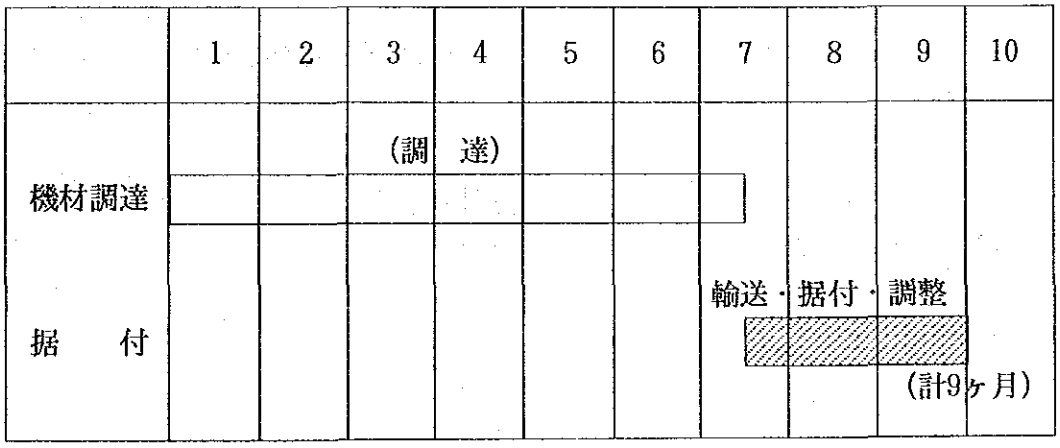
(3) 工事の完了

据付工事を完了した機材は、ﾀﾏｻｰﾄ工科大学、ｺﾝｻﾙﾀﾝﾄ及び関係者立会いのもとに、試運転を実施し、機器仕様と合致することを確認の上、ﾀｲ国側に引渡されて工事は完了する。ﾀｲ国側は工事完了証明を受注業者に発行すると共に、ｺﾝｻﾙﾀﾝﾄに対し業務完了証明書を発行する。すべての工事が円滑に行われるならば、機材供給契約後完了までの工事期間は約 9ヶ月と見込まれる。

以上の業務実施工程表を図 4.4.2に示す。

図 4.4.2　業務実施工程表





4.4.7 概算事業費

本計画を日本国政府の無償資金協力により実施する場合に必要となる事業費総額は約6.75億円となり、先に述べた日本とﾀｲ国の負担区分に基づく双方の経費内訳は、下記に示す積算条件によれば次の通りと見積もられる。

(1) 日本側負担経費

機材費	6.21 億円
設計監理費	0.43 億円
合計	6.64 億円

(2) ﾀｲ国側負担経費

ﾀｲ国側負担事業費は約2.52百万ﾊﾞｰﾂ（約 11百万円）と見込まれる。その内訳は次の通りである。

負担項目	金額（百万ﾊﾞｰﾂ）
改修・補修・機材基礎工事等	1.4
用役工事	0.05
空調設備工事	0.42
什器・備品調達	0.23
その他	0.42
（三相電源の配線工事 + 予備費 ： 上記総額の10%）	
合計	2.52

(3) 積算条件

概算事業費の積算に当たっては、下記を前提条件とした。

ｲ)	積算時点	平成5年9月
ﾛ)	為替交換レート	1US$ ＝ 109.84 円（平成5年3月から8月の平均）
		1ﾊﾞｰﾂ ＝ 4.36 円（ 〃 ）
ﾊ)	施工期間	業務実施工程表に示すとおり
ﾆ)	その他	本計画は日本国政府の無償資金協力の制度に従い実施されるものとする

第5章　事業の効果と結論

第５章　事業の効果と結論

5.1　事業の効果

ﾀｲ国政府は国内の急速な工業化を背景に、工業技術の高度化、多様化に対し研究開発能力を高めるため、高等教育における科学技術の教育体制の確立及び人材の育成を急務としている。第 7次経済社会開発 5ヶ年計画で大学の理工学系の学科の増強及び新設を計画した。その一環として ﾀﾏｻｰﾄ大学に工学部を新設したが、同大学に不足している教育・研究用の実験機材を整備し、同大学工学部設立の目的である同国の工業発展を担う高級技術者を育成しようとするのが本計画の目的である。この目的に対し、本計画の実施により期待される効果は表5.1.1のようになる。

表 5.1.1 計画実施による効果と現状改善の程度

現状と問題点	本計画での対策	計画の効果、改善程度
1) ﾀﾏｻｰﾄ大学工学部は新設後日が浅いので、建物の建設が優先し機材の整備はまだ不十分である。特に近代化した高ﾚﾍﾞﾙの機材は殆ど整備されていない。従って一応ｶﾘｷｭﾗﾑに沿った教育はしているが、高等教育に相応した内容の実験が出来ない状況である。	高等技術教育に基礎的に必要とされる近代的で、且つ取扱い維持管理の容易な実験用機材を、各学科の実験室に整備する。	工学部に必要とされる機材が整備され、工業の高度化、多様化に対応した高等技術教育が可能となり、強化される。それにより高ﾚﾍﾞﾙの技術を修得した卒業生を継続的に育成することが可能となり、慢性的に不足している同国の技術者需要の充足に貢献する。工学部の体制が充分に整った時点で、毎年の卒業生は250名から300名である。
2) 産業界における技術者の需要が高い為、若くて優れた素質のある人材を大学の教官として必要な数を確保するのが困難な状況にある。	教官の教育、研究の意欲を満足させることを考慮したﾚﾍﾞﾙの実験用機材を整備する。	大学を卒業しあるいは海外留学をした教官が必要とする機材を整備することにより、大学における教育、研究に誇りと使命感を持った能力と素質の優れた人材が、教官として確保できる。教官数、及び質を確保することにより、技術者の育成強化を質、量の両面から充実させることが出来る。
3) ﾀｲ国の大学は国立の研究機関や企業の技術部門として、国家や産業界の必要とする技術的問題を解決する役割も持っている。また産業界の技術者に対する基礎技術・革新技術の訓練機関の役割も期待されている。工学系の大学の数が限られているので新設の同大学工学部も、上記の期待に応えられる体制を整備する必要がある。	国家や企業の期待する研究に使用できる、また企業で使用される種類に近い機材を選定する。	機能の高い機材が多種類整備されることにより、各種の実験、試験、検査等が出来るようになり、国家の必要とする研究や産業界が要求する問題の解決等が可能になる。また産業界と関連した機材を使用して、技術者に対し基礎技術や革新技術を訓練するﾌﾟﾛｸﾞﾗﾑの実施が可能になる。これらにより大学の国家や産業界に対する技術的支援の役割が強化され産業の発展に貢献する

5.2 結論

工業の近代化を担う人材の育成は、ﾀｲ国の目標としている経済の安定成長、人的資源及び天然資源の開発及び生活の質及び環境の改善の為に重要な課題であり、特に急速な工業化により慢性的に不足している技術者の育成は急務である。本計画はﾀﾏｻｰﾄ大学工学部の教育ﾚﾍﾞﾙの向上をもたらし、結果として同国の産業の発展、国民生活の安定に寄与することから日本の無償資金協力で実施することは、妥当且つ必要であると判断される。本計画の運営・管理についても、ﾀｲ国側の体制は組織、要員、資金とも問題はないと考えられる。ただしその効果が十分に発揮されるためには、以下に述べるﾀｲ国側の自助努力が必要である。

(1) ﾀｲ国側負担事項の実施

本計画に基づく教育研究機材を設置する各実験室及び実験棟の改修工事、電気工事、ガス・給排水工事等の円滑な実施、及び日本側の機材供給業者が実施する陸揚げ、通関、国内輸送、搬入、据付までの安全確保、機材の破損防止、並びにこれらに伴う諸手続きの迅速な処理をする必要がある。

(2) 維持管理費の継続的確保

整備機材を活用するためには、適切な運営費の継続的確保は不可欠である。必要な維持管理費用について、政府及び大学が継続的に予算を確保し、初期の目的どおり機材が活用されるよう努力しなければならない。

(3) 担当者の訓練

機材を使用する教官、技官等のｽﾀｯﾌの増強、適切な配置、訓練は整備機材の活用のために必要である。機材の操作、維持管理の責任体制を整え、担当者の訓練を機材設置計画に併せて遅滞なく実行していく必要がある。

(4) 保守体制の整備

機材とともに整備される予備品や、機材の運転に必要な消耗品は一定量を常備する必要があり、その保管や在庫管理に留意しその補充を適切にしなければならない。また整備機材の取扱い説明書やマニュアルも、機材の運転、維持管理をする人が良く理解するとともに、責任者を定めその管理保管を良くすることが大切である。

資料編

資料－1　調査団の構成

1.1　基本設計調査

団　　長	西野　文雄	東京大学 工学部 土木工学科 教授
工学教育	伊藤　猷顯	長岡技術科学大学 電気系 教授
計画管理	小野　修司	国際協力事業団 無償資金協力調査部 基本設計調査第2課
工学教育計画	長沢　癸行	ユニコ　インターナショナル株式会社
教育機材計画	黒田　　孝	ユニコ　インターナショナル株式会社
機材配置	小針　輝夫	ユニコ　インターナショナル株式会社
積　　算	山内　伯文	ユニコ　インターナショナル株式会社

1.2　ドラフトレポート説明

団　　長	伊藤　　廣	長岡技術科学大学 機械系 教授
計画管理	福田　昇弘	国際協力事業団 無償資金協力調査部 基本設計調査第2課 課長代理
工学教育計画	長沢　癸行	ユニコ　インターナショナル株式会社
教育機材計画	黒田　　孝	ユニコ　インターナショナル株式会社

資料－2　調査日程

2.1　基本設計調査

日順	月日	曜日	調査行程	宿泊地	調査内容
1	7/11	日	(ｺﾝｻﾙﾀﾝﾄ) 東京→ﾊﾞﾝｺｸ (JL-717)	ﾊﾞﾝｺｸ	
2	7/12	月		同上	JICAｽｹｼﾞｭｰﾙ打合わせ、 ﾀﾏｻｰﾄ大学工学部実験室視察
3	7/13	火		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) ﾀﾏｻｰﾄ大学工学部、ｲﾝｾﾌﾟｼｮﾝﾚﾎﾟｰﾄ説明 ｽｹｼﾞｭｰﾙ打合わせ
4	7/14	水		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) ﾀﾏｻｰﾄ大学工学部打合わせ
5	7/15	木		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) 大学省表敬、ｽｹｼﾞｭｰﾙ説明、質疑応答 ﾀﾏｻｰﾄ大学、質問状説明
6	7/16	金		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) 大学省、ﾀﾏｻｰﾄ大学工学部、打合わせ
7	7/17	土		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) ﾀﾏｻｰﾄ大学要請機材打ち合わせ ﾊｲﾃｸ工業団地視察
8	7/18	日		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) 資料整理
9	7/19	月		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) ﾁｭﾗﾛﾝｺﾝ大学視察
10	7/20	火		同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) ﾀﾏｻｰﾄ大学ﾕｰﾃｨﾘﾃｨｰ調査
11	7/21	水	(官団員) 東京→ﾊﾞﾝｺｸ (TG-744)	同上	(ｺﾝｻﾙﾀﾝﾄ事前調査) 資料整理、ﾊﾞﾝｺｸ日本人商工会議所
12	7/22	木		同上	(官団員)DTEC,大学省表敬 (ｺﾝｻﾙﾀﾝﾄ)ﾕﾆｾﾌ事務所 JICA、大使館中間報告 ﾀﾏｻｰﾄ大学工学部、打合わせ
13	7/23	金		同上	ﾀﾏｻｰﾄ大学工学部、学科別面談
14	7/24	土		同上	資料整理、協議議事録原稿作成
15	7/25	日		同上	協議議事録原稿作成
16	7/26	月		同上	ﾀﾏｻｰﾄ大学工学部
17	7/27	火		同上	ﾀﾏｻｰﾄ大学（本部）協議議事録署名 JICA事務所、大使館報告
18	7/28	水	ﾊﾞﾝｺｸ→東京 (TG-772)		

2.1　ﾄﾞﾗﾌﾄﾚﾎﾟｰﾄ説明

日順	月日	曜日	調査行程	宿泊地	調査内容
1	9/21	火	東京→ﾊﾞﾝｺｸ (JL-717)	ﾊﾞﾝｺｸ	
2	9/22	水		同上	JICA打合わせ、DTEC表敬
3	9/23	木		同上	ﾀﾏｻｰﾄ大学工学部
4	9/24	金		同上	ﾀﾏｻｰﾄ大学工学部
5	9/25	土		同上	団内打合わせ、協議議事録原稿作成
6	9/26	日		同上	資料整理、ﾅﾜﾅｺﾝ工業団地視察
7	9/27	月		同上	大学省表敬、JICA事務所、大使館報告 ﾀﾏｻｰﾄ大学（本部）、協議議事録署名
8	9/28	火	ﾊﾞﾝｺｸ→東京 (TG-772)		

資料－3　面談者リスト

ﾀﾏｻｰﾄ大学

Associate Prof. SETABUTR, Noranit
Rector

Dr. POONPRASIT, Viboonpong
Vice Rector for International Affair

Ms. POKTHITIYUK, Yupin
Assistant to Vice Rector for International Affair

Mr. KATEKINTA, Sathaporn
Acting Dean, Faculty of Engineering

Dr. PRAPARNTANATORN, Somnuke
Assistant Dean for Administration
Head of Civil Engineering Dept.

Mr. KIJKANKANARAT, Taweesak
Head of Electrical Engineering Dept.

Mr. CHAROEPORN, Naris
Head of Industrial Engineering Dept.

Mrs. COOVATTANACHAI, Sunee
Head of Mechanical Engineering Dept.

Mr. DHUPATEMIYA, Pongtorn
Head of Chemical Engineering Dept.

Dr. WEESAKUL, Uruya
Assistant Dean for Research and Foreign Affairs
Lecturer of Civil Engineering Dept.

Mr. PISITPAIBOOL, Chaisak
Assistant Dean for Academic Affairs

Mr. SMITAKORN, Watanachai
Asistant Dean for student Affairs
Lecturer of Civil Engineering Dept.

Mrs. PANCHAT, Baisak
Assistant Dean for Planning and Development

Miss KATCHAMART, Sunisa
Lecturer of Civil Engineering Dept.

Mr. CHAIKUNCHUENSAKUN, Sotok
Lecturrer of Chemical Engineering Dept.

Mr. SUPPACHAI, Vorapojpisut
Lecturer of Electrical Engineering

Mr. TONGPRASITH, Annan
Lecturer of Electrical Engineering

Mr. MALEEVAN, Charkree
Lecturer of Electrical Engineering

Mr. TAECHANUKULCHAI, Veerawat
Lecturer of Electrical Engineering

Mr. AREE, Pichal
Lecturer of Electrical Engineering

Ms. SUNTAD, Vanee
Secretary of the Faculty of Engineering

国立科学技術開発庁

Prof. Dr. COOVATTANACHAI, Naksitte
Deputy Director(Former Dean, Faculty of Engineering, Thammasat University)

大学省

Prof. Dr. SRISAAN, Wichit
Permanent Secretary

Prof. WATANACHAI, Kasem M.D.
Deputy Permanent Secretary

Dr. SUJATANOND, Chantavit
Director of Foreign Relations Division

Ms. KETANITINAN, Vandee
Chief of Asian Corporation Section, Foreign Relations Division

技術経済協力局

Mr. SIRIVAT, Nipon

Mr. AMORNCHEWIN, Banchong
Japan Sub-Division

チュラロンコン大学

Dr. SMITRA, Tacha
Dean, Faculty of Engineering

Dr. SANEVERAPHUNSIRI, Viboon
Mechanical Engineering Department

Dr. PRASERTAEDAM, Piyasan
Chemical Engineering Dept.

Dr. KRUANGAM, Dusit
Electrical Engineering Dept.

Dr. TANTHAPANICHAKORN, Wiwut
EIRD of Chulalongkorn Univ.

Dr. LIMSUWAN, Ekasit
Civil Engineering Dept.

バンコク日本人商工会議所

羽田　良樹　　専務理事

日本大使館

田中　信明　　参事官
館　逸志　　一等書記官
佐藤　地　　一等書記官
折原　守　　一等書記官
渡辺　浩司　　二等書記官

JICA タイ事務所

表　伸一郎　　所長
芦野　誠
大沢　英生
稲垣　富一　　技術経済協力局、技術協力調整（JICA専門家）

資料－4　協議議事録

4.1　基本設計調査

MINUTES OF DISCUSSION
ON
BASIC DESIGN STUDY
FOR
THE PROJECT FOR EXPANSION OF THE FACULTY OF ENGINEERING
AT THE THAMMASAT UNIVERSITY
IN THE KINGDOM OF THAILAND

In response to a request of the Government of the kingdom of Thailand, the Government of Japan decided to conduct a Basic Design study on the Project for Expansion of the Faculty of Engineering at Thammasat University(hereinafter referred to as"the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Kingdom of Thailand a study team headed by Dr.Fumio Nishino, Professor, Tokyo University, and is scheduled to stay in the country from 11 July to 28 July, 1993.

The Team held discussion with the officials concerned of the Government of Thailand and conducted field surveys at the study area

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepared the Basic Design Study Report.

Bangkok, 27 July, 1993

Prof. Fumio Nishno
Leader,
Basic design Study Team,
(JICA)

Prof.Noranit Setabutr
Rector
Thammasat University

P.P. Prof.Kasem Watanachai
Deputy Permanent Secretary
Ministry of University Affairs

ATTACHMENT

1. Objective of the Project

The objective of the Project is to supply the equipments for the Faculty of Engineering at Thammasat University.

Due to the shortage of engineers, the Thai industries have been facing great difficulties for technical development. The Faculty of Engineering of Thammasat University has been established to provide appropriate engineering education and training to its student.

The educational equipment will reinforce the teaching capability of the faculty of Engineering to supply its students and staff with high standards of knowledge.

2. Project Site

The site of the Project is located at Rangsit, Pathum-Thani; (Project area and site map are attached as ANNEX-I.)

3. Executing Agency

Responsible Agency: The Thammasat University

4. Items requested by the Government of Thailand are attached as ANNEX-II.

5. Japan's Grant Aid Program

(1) The Government of Thailand has understood the system of Japanese Grant Aid explained by the team.

(2) The Government of Thailand will take necessary measures, described in ANNEX III, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

N.S.

4. Civil Engineering

4.1 Structural Loadng System
Consist of:
a) Loading System
b) Loading Frame
c) Measuring Equipment
d) Machinery for Machine Shop

4.2 Computer and Software with printers

4.3 Instrument for Control Room of app.4 x 7 x 4m

4.4 Universal Material Testing Machine with Servo Valve Control

4.5 Universal Testing Machine

5. Chemical Engineering

(Group I)

5.1.1 Liquid-Liquid Extraction System
5.1.2 Fluid-Solid Extraction System
5.1.3 Process Control Test Set
5.1.4 Continuous Plate Distillation Unit
5.1.5 Batch Packed Distillation Unit
5.1.6 Spray Dryer
5.1.7 Stirred Liquid Phase Reaction Unit
5.1.8 Fluidized-bed Reactor
5.1.9 Fixed-bed Reactor
5.1.10 Stirrers Set
5.1.11 Drum Dryer
5.1.12 Ball Mill Set
5.1.13 Glassware for Analytical Chemistry Laboratory
5.1.14 Glassware for Organic Chemistry Laboratory
5.1.15 PCs

(Group II)

5.2.1 X-ray Diffractometer

5.2.2 X-ray Fluorescence Spectrometer
5.2.3 Ion-Chromatograph
5.2.4 Scanning Electron Microscope
5.2.5 UV-Visible Spectrophotometer
5.2.6 Atomic Absorption Spectrophotometer
5.2.7 Gas Chromatograph
5.2.8 Thermal Analysis Instrument
5.2.9 High Performance Liquid Chromatograph
5.2.10 Fourier-Transform Infrared Spectrophotometer

6. Mechanical Engineering

6.1 Eddy Current Dynamometers

6.2 Exhaust Gas Analyzer

6.3 Diesel Engine Fuel Pump Test Set

6.4 Internal Combustion Engine Test Bed for Variable Compression Ratio

6.5 Steam Power Plant Test Set Complete with Data Acquisition System

6.6 Gas Turbine Plant Test Set Complete with Data Acquisition System

6.7 Pneumatic Control System

6.8 Hydraulic Control System

6.9 Calorimeter for Determining the Capacity of the Air-conditioning System

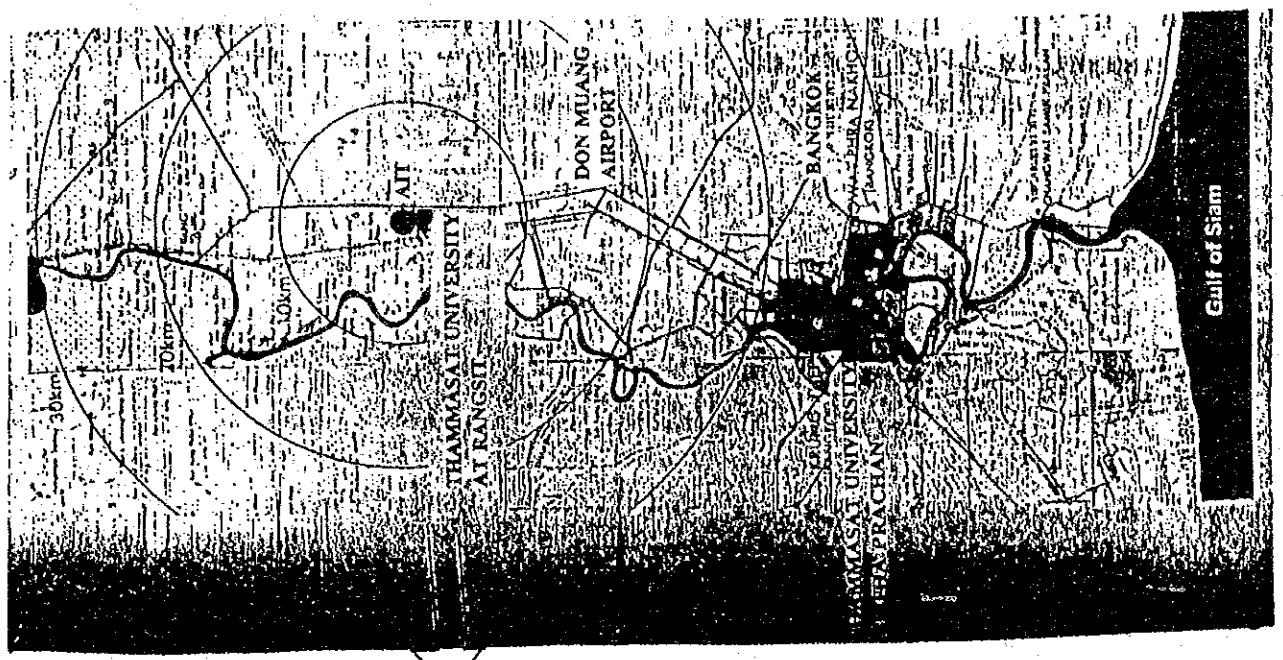
6.10 Personal Computers

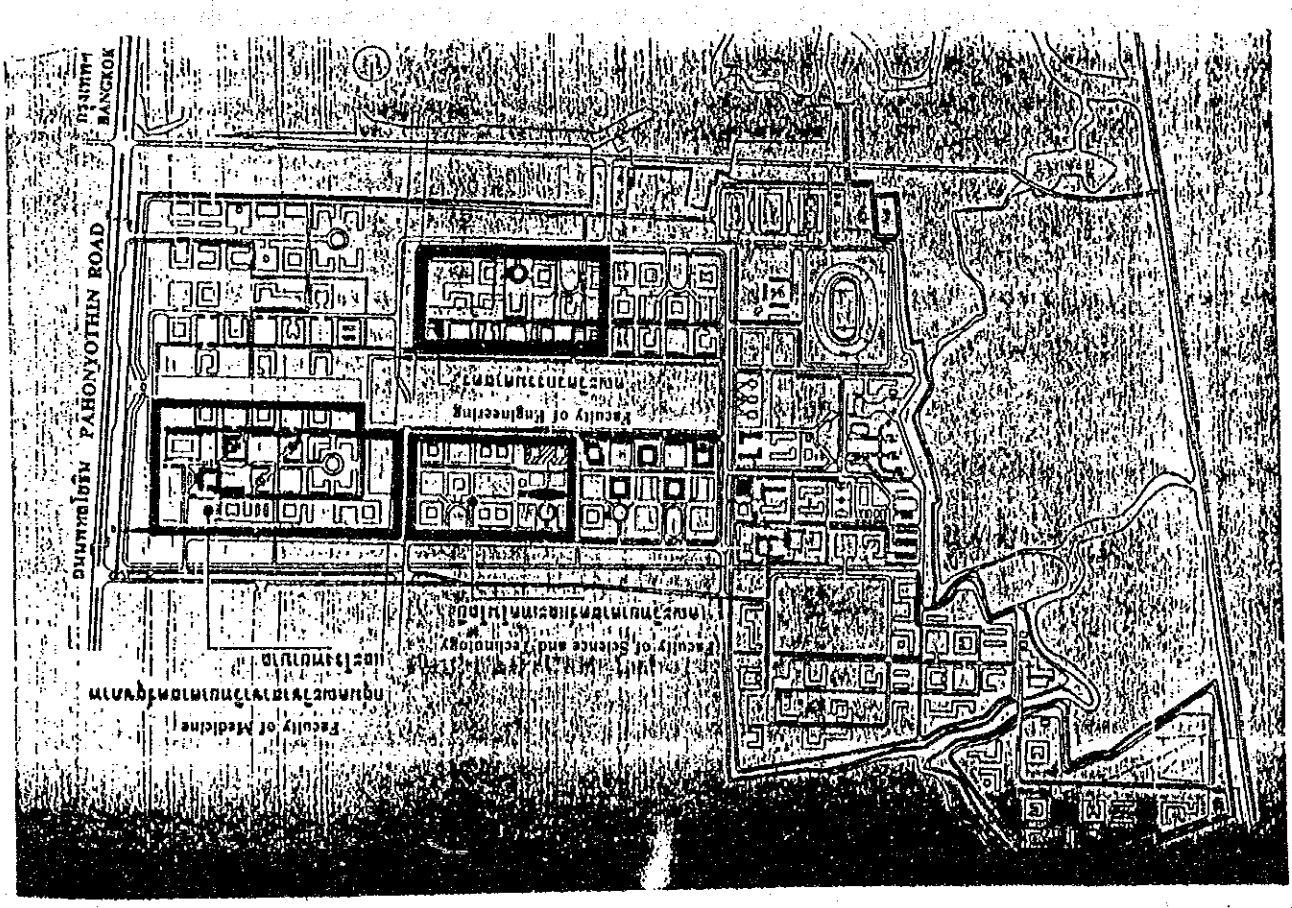
Remarks: Items requested by Thai side will be finalized through further study.

N.S.

ANNEX - I

LOCATION OF THE THAMMASAT UNIVERSITY, FACULTY OF ENGINEERING
AND
MAP OF THE THAMMASAT UNVERSITY AT RANGSIT





ANNEX II

SUMMARY OF REQUIRED EQUIPMENT LIST FROM EACH OF DEPARTMENT
UNDER
THE PROJECT FOR EXPANSION OF THE FACULTY OF ENGINEERING
AT THAMMSAT UNIVERSITY THE KINGDOM OF THAILAND

1. Shared Equipment

1.1 Audio-Visual facilities for 150 seat lecture auditorium

1.2 Video Library Equipment

1.3 Personal Computer and related facilities

1.4 Engineering Workstation Lab. Equipment(workstation & etc.)

1.5 25 Seats Project Coach

2. Electric Engineering Laboratory

2.1 Equipment for Electro-Mechanical Energy Conversion Lab.,

2.2 Equipment for Electronic Laboratory

2.3 Equipment for Communication Laboratory

2.4 Equipment for Instrumentation and Control System Laboratory

2.5 Personal Computers

3. Industrial Engineering

3.1 Equipment for CNC Laboratory

3.2 Equipment for CAD/CAM Laboratory

3.3 Equipment for Precision Laboratory

ANNEX-III

Necessary measures to be taken by the Government of the Kingdom Thailand are as follows;

1. To provide necessary permissions, license and other authorizations for smooth implementation of the Project.

2. To bear advising commission of the Authorization to pay(A/P) and payment commission to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement(B/A)

3. To ensure prompt unloading, tax exemption, and custom clearance of the goods for the Project at port of disembarkation in Thailand.

4. To ensure prompt unloading and internal transportation of the goods purchased and/or imported under the Grant Aid for the Project.

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 work.

6. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in Thailand with respect to the supply of the products and services under the verified contracts.

7. To maintain and use properly and effectively the equipment and materials provided under the verified contracts.

8. To bear all the expenses other than those to be by the Grant, necessary for the transportation of the equipment.

9. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.

N. S.

J.N.

C.S.

6. Schedule of the Study

(1) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents in the end of September, 1993.

(2) In case that the contents of the report is accepted in principle by the Government of Thailand, JICA will complete thefinalreport and send it to the Government of Thailand by November, 1993.

N.S.

J.N.

C.S.

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE PROJECT FOR EXPANSION OF THE FACULTY OF ENGINEERING
AT THAMMASAT UNIVERSITY
IN THE KINGDOM OF THAILAND

(CONSULTATION ON DRAFT REPORT)

In July 1993, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study team on the Project for Expansion of the Faculty of Engineering at the Thammasat University (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 Prof. Dr. Hiroshi ITO, Mechanical Engineering Department Nagaoka University of Technology, and is scheduled to stay in the country from 21 September to 28 September, 1993.

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

Bangkok, September 27, 1993

伊藤 廣

Prof. Hiroshi ITO
Leader
Draft Report Explanation Team
JICA

Noranit Setabutr

Assoc. prof. Noranit Setabutr
Rector
Thammasat University

P.P. Chaiwat Sujatanond

Prof. Kasem Watanachai

ATTACHMENT

1. Components of draft report

The Government of Thailand has agreed and accepted in principle the components of the Draft Report proposed by the team with requests for some modifications in the equipment selection.

2. Department of Mechanical Engineering

The Government of Thailand has assured that the Department of Mechanical Engineering will increase its staff members and start its courses as scheduled before the equipment to be provided through this project is installed.

3. Japan's Grant Aid system

(1) The Government of Thailand has understood the system of Japanese Grant Aid explained by the Team.

(2) The Government of Thailand will take the necessary measures, described in ANNEX for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

4. 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 November 1993.

伊藤

N.S.

CS.

Annex: Necessary measures to be taken by the Government of Thailand in case Japan's Grant Aid is extended.

1. To provide necessary permissions, license and other authorization for smooth implementation of the Project.

2. To bear advising commission of the Authorization to pay (A/P) and payment commission to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement (B/A).

3. To ensure prompt unloading, tax exemption, and custom clearance of the Project at the port of disembarkation in Thailand.

4. To ensure prompt unloading and internal transportation of the goods purchased and/or imported under the Grant Aid for the Project.

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 work

6. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Thailand with respect to the supply of the equipment and materials provided under the verified contract.

7. To maintain and use properly and effectively the equipment and materials provided under the verified contract.

8. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.

9. To bear all the expenses other than those to be borne by the Grant, necessary for the transportation and the installation of the equipment.

伊藤

n. S.

CS.

2.1 Share Equipment Requested from Japanese Government

2.1.1 Audio-Visual facilities

No.	Item of Equipment	Specification	Amount Request	Utility
1.	AUDIO-VISUAL FACILITIES FOR 150 SEATLECTURE AUDITORIUM			
	1.1 AUDIO SYSTEM			
	-UHF Synthesized Wireless Microphone System	This system consists of the shown below:	1 Set	In engineering courses, many courses are either pure theory or practical subject. Both video system and presentation system can assist not only for student to understand the hard-to-imagined picture but also for lecturers to exlplain that particular topic easier. Audio system can create the real environment for each presentation and also enhance the capability of audio vision of the meeting, conferrence or other activities. The educational videoes can be produced by the camera sets both indoor and outdoor and editing job can be completed in the studio by the video systems.
		Handy type wireless 5 Sets		
		Microphone stand set 1 Set		
		Tie-clip type wireless 5 Sets		
		Antenna, antenna divider and for wireless mic. up to 8 1 Set		
	-Dynamic Microphone	This system consists of the shown below:	1 Set	
		Uni-directional microphone 3 Sets		
		Microphone cable 1 Set		
		Microphone Stand Set 1 Set		
	-Tape Recorder, Mixer and Power Amplifier	Cassette tape recorder 1 Set		
		8-channel audio mixer 1 Set		
		Supplementary audio mixer 1 Set		
		Parametric Equalizer 1 Set		
		Dual-channel/mono power output power 50W+50W 100W monaural 2 Sets		
		Speaker and speaker holder	2 Pairs	
	Cables and accessories		1 Set	
	VIDEO SYSTEM:-			
	Videocassette Records			
		Recorder/Player, U-matic	1 Set	
		Player U-matic	2 Sets	
		Portable recorder,U-matic	1 Set	
		Frame code generator	1 Set	
		14-inch colour video monitor	3 Sets	
		Mounting bracket	3 Sets	
		Remote control unit	2 Sets	
		RF Modulator	2 Sets	
		33-pin interface board	1 Set	
		U-matic video cassette tape	50 Pcs	
		U-matic portable video cassette	50 Pcs	
		Connecting cable and	1 Set	
	PRESENTATION SYSTEM:-			
		Overhead projector	2 Sets	

2.1 Share Equipment Requested from Japanese Government

2.1.1 Audio-Visual facilities

No.	Item of Equipment	Specification	Amount Request	Utility
		Direct projector	1 Set	
		Slide projector with remote	2 Sets	
		PC-Viewer with overhead	1 Set	
		Stand screen 100*100 inch	2 Sets	
		Multi-scan projector with	1 Set	
	CAMERA SET			
	Colour Video Camera			
		3-chip CCD colour video	1 Set	
		Electret condenser microphone	1 Set	
		3-chip CCD colour video	1 Set	
		3-chip CCD colour video	1 Set	
		Camera control unit	1 Set	
		Tripod with dolly	1 Set	
		Tripod adaptor	1 Set	
		20-inch colour video monitor	1 Set	
		14-inch colour video monitor	1 Set	
		Mounting bracket	2 Sets	
		Cable and accessories	1 Set	

2.1.2 Video Library

No.	Item of Equipment	Specification	Amount Request	Utility
2.	VIDEO LIBRARY			
	Headphone		50 Sets	After filming the educational video, student can be self-studied in the private booth. And other video sources can be viewed in the video library as well.
	Multi-system color TV	14-inch multi-system color TV	25 Sets	
	Multi-system VHS video players	Video signal PAL/NTSC	25 Sets	
	Booths		25 Sets	
	Chairs		50 Sets	
	Video-tape storage cabinets		6 Sets	

2.1.3 Personal Computor Lab

No.	Item of Equipment	Specification	Amount Request	Utility
3.	PERSONAL COMPUTER LAB HARDWARE:- Personal computer	CPU Intel 80486DX2-66 RAM 8 MB 1*240 MB hard disk EISA or Micro Channel bus Three or more expansion slots 2 serial, 1 parallel and 1 mouse 101-key or 102-key keyboard One mouse with mouse pad SVGA color monitor 14" SVGA 1024*768 at 256 color	50 Sets	Personal computers are widely used in all the engineering area in basic designing, analysis especially in computer graphic. All of junior student will receive tremendous benefit from this computer lab. The multi-system video projector can help lecturer to teach directly from the computer.
	LAN server	CPU Intel 80486DX2-66 RAM 8 MB 1*1.44 MB+1*1.2 MB disk 1*2 GB SCSI-2 hard disk Tape backup 120 MB EISA or Micro Channel 32-bit Five or more 32-BIT expansion 2 serial, 1 parallel and 1 mouse 101-key or 102-key keyboard One mouse with mouse pad SVGA color monitor 14" SVGA 1024*768 at 256 color	1 Set	
	Ethernet card and cables system for personal computer and LAN server			
	Line Printer (Speed 400 cps or more)			
	Dot-matrix printer			
	Pen and Pencil Plotter A0 Size			
	100-inch Video Screen			
	Multi-scan Video Projector			
	Computer Screen Panel Projector			
	Audio System			
	LAN software			

2.1.4 Engineering Wordstation Lab

No.	Item of Equipment	Specification	Amount Request	Utility
4.	ENGINEERING WORDSTATION LAB			
	Workstation		10 Users	In final year of study, student
	UPS		1 Set	requires skill on workstation to
	Digitizer		2 Sets	analyse the complicated problem
	Plotter		1 Set	which can be useful in the job.
	General software			
	SOFTWARE			
	Electrical engineering			
	PSpice	Analysis electronic circuit	15 Users	Most widely use in education.
	V System	Simulate digital circuit	15 Users	IEEE's digital simulation language
	Mathematica	Powerful mathematic software	10 Users	Symbolic manipulation feature
	Chemical engineering			
	ASPEN/SP	A steady-state chemical process refining, gas processing, generation, metallurgical,pulp,	1 User	
	BATCHES/SE	A simulator is for managing and semicontinuous flow	1 User	
	POLYGRAF	To design and simulate the enhanced properties.	1 User	
	Civil engineering			
	ERDAS	Satellite image processing	1 User	To use for processing data from satellite which can be used for the application of remate sensing in water resources engineering
	Architecture & engineering integrated software	A set of softwares on PC or and drafting system for building management	1 User	To study structural behaviors by using computer simulation and to practice the design and construction of buildings by using computer aided design.
	Mechanical engineering			
	Mechanical Engineering Workbench	Provides an integrated software engineer to use during the verification phase of product is	1 User	
	Pro/DETAIL	an optional module for engineering drawing capabilities drafting standards.	1 User	
	Pro/ENGINEER	Is a CAD/CAM application that engineering automation tools driven, solid modeling	1 User	
	Industrial engineering			
	LINDO	is an interactive computer and quadratic programming	1 User	Educational documents and sheets
	Siman Simulation Language (Version 4.0)	is a general purpose process-	1 User	can be produced by the document production system.

2.1.5 Documents, Project Car and Journals

No.	Item of Equipment	Specification	Amount Request	Utility
5.	DOCUMENT PRODUCTION SYSTEM			This system is selected for easily use and maintenance.
	Offset printing system		1 Set	
	Book binding machine			
	Heavy-duty photocopier		2 Sets	
	Colour photocopier		1 Set	
6.	PROJECT CAR	Air-condition mini bus 25 seats	1 Set	This mini-bus is for a group of student to travel to seminar, or other activities.
			TOTAL	

1. Electromechanical Energy Conversion Laboratory

No. EL-	Item of Equipment	Specification	Amount Request	Utility
1.1	Three-Phase Squirrel-Cage Induction Motor Laboratory Set	This set of equipment consists of		
		-Fuse 2amp and socket 16amp for controller	1 Set	
		-3 fuses and socket with fuse plugs for motor	2 Sets	
		-Circuit breaker, 3-pole 16A/500VAC	1 Set	
		-Reversing switch, 3-pole 16A/500VAC	1 Set	
		-Contactor 220V 50Hz, 3-pole 16A/400VAC, with auxiliary switch 2 make and 2 break contacts	5 Sets	
		-Over-current relays with auxiliary switch 1 make and 1 break contact,		
		-1.6A to 2.5A	1 Set	
		-2.5A to 4A	1 Set	
		-4A to 6.3A	1 Set	
		-Pushbotton switch ON : 1 make and 1 break contact OFF: 1 break and 1 make contact	7 Sets	
		-Two-circuit double interruption switch, 3-pole 16A/380VAC, switch position 0-I-II	2 Sets	
		-Eddy-current brake with electronic torque load cell 1.2Kw	1 Set	
		-Control unit for speed and torque measurement of the eddy current break	1 Set	
		-Three-phase squirrel-cage induction motor suitable for star-delta starting 380V, 50Hz, 1KW, 1500rpm.	1 Set	
		-Three-phase two speed pole-changing induction motor with squirrel-cage rotor 380V/50Hz 1KW, 1500rpm.	1 Set	
		-Dahlander circuit	1 Set	
		-Two separate windings	1 Set	
		-Baseframe for motor set two expermental machines	2 Sets	
		-Pilot lights 220VAC	2 Sets	
		-2 limit switchs, 1 break contact	1 Set	
		-Triple-pole ON/OFF switch 16A/500VAC	1 Set	

1. Electromechanical Energy Conversion Laboratory

No. EL-	Item of Equipment	Specification	Amount Request	Utility
		-Two-pole ON/OFF switch 16A/380VAC switch position 0-I-0-II	1 Set	
		-Pole-changing switch 16A/500V		
		-Dahlander circuit	1 Set	
		-Two separate windings	1 Set	
		-Star-delta switch, 3-pole 16A/500VAC	1 Set	
		-Contactor, 220V 50Hz, auxilary conductor 6A/380VAC 4 make and 4 break contacts	3 Sets	
		-Time relay, 30 sec., 2 contacts	1 Set	
		-Capacitor 450V, 3uF	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.2	Three-Phase Slipring Induction Motor Laboratory Set	This set of equipments consists of		
		-Fuse 2A and socket 16A for controller	1 Set	
		-3 fuses and socket 16A with fuse plugs for motor	1 Set	
		-Contactor 220V 50Hz, 3-pole 16A/500VAC, with auxiliary switch 2 make and 2 break contacts	3 Sets	
		-Auxiliary contactor 6A/380V, 220V, 50Hz, 4 make and 4 break contacts	1 Set	
		-Over-current relays 1.6-2.5A with auxiliary switch, 1 make and 1 break contact	1 Set	
		-Time relay 30 sec., 2 contacts	2 Sets	
		-Pushbotton switch ON : 1 make and 1 break contact OFF: 1 break and 1 make contact	7 Sets	
		-Eddy-current brake with electronic torque load cell 1.2KW	1 Set	
		-Control unit for speed and torque measurement of the eddy current breake	1 Set	
		-Three-phase induction motor with slipring rotor, 380/220V, 50Hz, 1KW	1 Set	
		-Controller for three-phase induction motor with slipring rotor	1 Set	
		-Base frame to machine	1 Set	
		-Single-coil slide resistor 100ohms 2A	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.3	DC Motor Laboratory Set	This set of equipments consists of		
		-Fuse 2A and socket 16A for controller	1 Set	
		-Incandescent lamp sockets	3 Sets	
		-3 fuses and socket with fuse plugs for motor	4 Sets	
		-Contactor 220V 50Hz, 3-pole 16A/500VAC with auxiliary switch 2 make and 2 break contacts	3 Sets	
		-Over-current relays 1.6-2.5A with auxiliary switch 1 make and 1 break contact	1 Set	
		-Time relay 30 sec., 2 contacts	2 Sets	
		-Pushbotton switch ON : 1 make and 1 break contact OFF: 1 break and 1 make contact	5 Sets	
		-2 pole on/off switch, switch position: 0-I-0-I, 16A 380V	1 Set	
		-Two-circuit double interruption switch 16A/380VAC, switch position: 0-I-0-II	1 Set	
		-Eddy-current brake with electronic torque load cell 1.2KW	1 Set	
		-Control unit for speed and torque measurement of the eddy-current brake	1 Set	
		-DC separate wound machine, 220V, 1500rpm, 1KW	1 Set	
		-Dc compound wound machine, 1500rpm 220V, 1KW	1 Set	
		-Controller for starting motor	1 Set	
		-Single coil slide resistor, 100ohm 2A	1 Set	
		-DC series wound machine, 220V, 1500rpm, 1KW	1 Set	
		-DC shunt wound machine, 1500rpm, 220V, 1KW	1 Set	
		-Base frame for two machines	1 Set	
		-Controller for starting of DC machine	1 Set	
		-Single-coil resistor 200ohms, 2A	1 Set	
		-Single-coil resistor 1000ohms, 1.5A	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.4	DC Generator Laboratory Set	This set of equipments consists of		
		-Contactor 220V 50Hz, 3-pole 16A/500VAC with auxiliary switch 2 make and 2 break contacts	3 Sets	
		-Incandescent lamp sockets	3 Sets	
		-3 fuses and soket with fuse plugs for generator	4 Sets	
		-Over-current relays 1.6-2.5A with auxiliary switch, 1 make and 1 break contact	1 Set	
		-Time relay 30 sec., 2 contacts	1 Set	
		-Pushbotton switch ON : 1 make and 1 break contact OFF: 1 break and 1 make contact	2 Sets	
		-ON/OFF switch, 2-pole 16A/380V, switch position: 0-I-0-I	3 Sets	
		-Two-circuit double interruption switch, 3-pole 16A/380VAC,switch position 0-I-0-II	1 Set	
		-DC compound-wound machine, 1500rpm, 220V, 1KW	1 Set	
		-DC separate wound machine 220V, 1500rpm, 1KW	1 Set	
		-Controller for starting motor	1 Set	
		-Base frame for two machine	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.5	Single-Phase Motor Laboratory Set	This set of equipments consists of		
		-Fuse 2A and socket 16A for controller	1 Set	
		-3 fuses and socket with fuse plugs for motor	1 Set	
		-Circuit breaker, 3-pole 16A/500VAC	1 Set	
		-Contactor 220V 50Hz, 3-pole 16A/500VAC, with auxiliary switch 2 make and 2 break contacts	3 Sets	
		-Capacitor, 450V, 3uF	3 Sets	
		-Pushbotton switch		
		ON : 1 make and 1 break contact	4 Sets	
		OFF: 1 break and 1 make contact	1 Set	
		-ON/OFF switch, 2-pole 16A/380V, switch position: 0-I-0-I	1 Set	
		-Two-circuit double interruption switch, 3-pole 16A/380VAC, switch position: 0-I-0-II	1 Set	
		-Eddy-current break with electronic torque load cell 1.2KW	1 Set	
		-Control unit for speed and torque measurement of the eddy current break	1 Set	
		-Single-phase squirrel-cage motor running capacitor, 1KW, 220V, 1500 rpm., 50Hz	1 Set	
		-Single-phase squirrel-cage motor running and starting capacitor, 1KW, 220V, 50Hz, 1500rpm.	1 Set	
		-Single-phase repulsion motor 220V, 50Hz, 1KW, speed control range from 0 to 3000rpm.	1 Set	
		-Universal motor, 220V, 50Hz, 1KW, 3000rpm.	1 Set	
		-Base frame for two machines	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.6	Three-Phase Synchronous Motor Laboratory Set	This set of equipments consists of		
		-Fuse 2A and socket 16A for controller	1 Set	
		-3 fuses and socket with fuse plugs for motor	2 Sets	
		-Circuit breaker, 3-pole 16A/500VAC	1 Set	
		-Reversing switch, 3-pole 16A/500VAC	1 Set	
		-Contactor 220V 50Hz, 3-pole 16A/500VAC with auxiliary switch, 2 make and 2 break contacts	3 Sets	
		-Over-current relays with auxiliary switch 1 make and 1 break contact		
		-0.63 to 1.4A	1 Set	
		-1.6 to 2.5A	1 Set	
		-Time relay 30 sec., 2 contacts	1 Set	
		-Pushbotton switch ON : 1 make and 1 break contact OFF: 1 break and 1 make contact	2 Sets	
		-ON/OFF switch, 2-pole 16A/380V, switch position: 0-I-0-I	1 Set	
		-Two-circuit double interruption switch, 3 pole 16A/380VAC switch position: 0-I-0-I	1 Set	
		-Eddy-current break with electronic torque load cell 1.2KW	1 Set	
		-Control unit for speed and torque measurement of the eddy current break	1 Set	
		-Three-phase synchronous machine with salient pole rotor, 380V/220V for motor operation, 400/230V for generator operation, 1KW, 50Hz	1 Set	
		-Three-phase synchronous motor with no excitation (reluctance motor) 380V star, 50Hz, 1500rpm		
		-Base frame for two machines	1 Set	
		-Single-coil slide resistor 200ohms, 2A	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.7	Three-Phase Synchronous Generator Laboratory Set	This set of equipments consists of		
		-Fuse 2A and socker 16A for controller	1 Set	
		-3 fuses 16A/380VAC fuse plugs for motor	4 Sets	
		-3 Incandescent lamp sockets	1 Set	
		-Time relay 30 sec., 2 contacts	1 Set	
		-Circuit breaker, 3-pole 16A/500VAC	1 Set	
		-Triple-pole ON/OFF switch 16A/500VAC	3 Sets	
		-Reversing switch, 3 pole 16A/500VAC	1 Set	
		-Contactor 220V 50Hz, 3-pole 16A 500VAC with auxiliary switch 2 make and 2 break contacts	1 Set	
		-Over-current relays 0.63-1A with auxiliary switch 1 make and 1 break contact	1 Set	
		-Push botton switch ON : 1 make and 1 break contact OFF: 1 break and 1 make contact	2 Sets	
		-Two pole ON/OFF switch 16A/380VAC, switch position: 0-I-0-I		
		-Two-circuit double interruption switch, switch position: 0-I-0-II	4 Sets	
		-Pilot lights	6 Sets	
		-DC shunt wound motor, 220V, 1KW, 1500rpm.	1 Set	
		-Three-phase synchronous machine with salient pole rotor, 380V/220V for motor operation, 400/230V for gererator operation, 1KW, 50Hz	1 Set	
		-Three-phase synchronous machine with no excitation (reluctance machine) 380V star, 50Hz, 1500rpm	1 Set	
		-Controller for starting DC motor	1 Set	
		-Single slide resistor, 1000ohms, 1.5A	1 Set	
		-Base frame for two machines	1 Set	
		-Synchroscope 380VAC	1 Set	
		-Phase-sequence indicator	1 Set	
		-Double frequency meter	1 Set	
		-Resistive load 6KW, 3-phase	2 Sets	
		-Inductive load 6KW, 3-phase	1 Set	
		-Capacitive load 6KW, 3-phase	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.8	Transformer Laboratory Set	This set of equipments consists of		
		-Single-phase transformer Primary voltage: 2 x 110V, 50Hz Secondary voltage: 2 x 110V Rated output: 2.5KVA	1 Set	
		-Three-phase transformer Primary-phase voltage: 380V Secondary-phasse voltage Y,Z = 380V, Delta = 220V Rated output: 4KVA	1 Set	
		-Fuse with fuse pluge for 1 phase transformer	1 Set	
		-Fuses with fuse plugs for 3 phase transformer	1 Set	
		-Triple-pole, ON/OFF switch 3 phase transformer	1 set	
		-Two-pole, ON/OFF switch 1 phase transformer	1 Set	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.9	Amplidyne-Generator Laboratory Set	This set of equipments consists of		
		-Fuse 2A and socket 16A for controller	4 Sets	
		-3 fuses and socket with fuse plugs for motor	4 Sets	
		-Circuit breaker, 3-pole 16A/500VAC	2 Sets	
		-Contactor 220V 50Hz, 3-pole 16A/500VAC, with auxiliary switch 2 make and 2 break contactor	2 Sets	
		-Over-current relay 1.6-2.5A with 1 make and 1 brake contact	3 Sets	
		-Pushbotton switch		
		ON : 1 make and 1 break contact	2 Sets	
		OFF: 1 break and 1 make contact	2 Sets	
		-Three-phase squirrel cage induction motor star-delta starting 380V, 50Hz, 1KW	1 Set	
		-DC compound wound machine 150rpm. 220V 1KW	2 Sets	
		-Controller for starting DC motor	1 Set	
		-Amplidyne generator 1KW, 220V	1 Set	
		-Single slide resister 100ohm 1.5A	1 Set	
		-Base frame for two machine	2 Sets	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.10	Power Electronic Equipments			
1.10.1	Converter	This equipment is used for controlling speed of induction motor	1	
1.10.2	VVVF (Varied Voltage and Varied Frequency)	This equipment is used for controlling speed of induction motor and making torgue constant	1	
1.10.3	Chopper	This equipment is used for controlling speed of DC machine	1	

1. Electromechanical Energy Conversion Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.11	Connecting leads	2.5mm2 with 4mm safety plugs for 32A		
		length = 25cm, red	240	
		length = 30cm, red	240	
		length = 50cm, red	240	
		length = 50cm, red	240	
		length = 100cm, red	120	
		length = 100cm, red	120	
		length = 150cm, red	180	
		length = 150cm, red	180	

2. Electronic Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
2.1	Printed Circuit Board (PCB) Design Fabrication, and Testing Software Packages for PCBs design	A set of software packages on the PCs or the workstations analyses, designs, and simulates analog and digital circuits and making the PCB layout.		This set of equipments is used as basic tools in dsigning, fabricating, and testing Printed Circuit Boards in order to make convenience and reliability of senior projects which need many prototype circuit boards.
2.1.1	IC Design Software Package Workview Viewlogic Systems, Inc.	Software package on the workstation or PCs supports all the capabilities needed for every step of the IC design process.	1 Set	
2.1.2	Circuit Schematic Simulation Software Packages Design Center MicroSim Corp. V-System/Windows Model Tech., Inc.	Software Package running on PC provides with an integrated environment to 1.analyze circuit in time domain (with 5,700 + parts library) 2.analyze digital circuit by VHDL	 1 Set 1 Set	
2.1.3	PCB Layout System P-cad Personal CAD Systems, Inc. Equipments for PCB fabrication	This system consists of 1.Software package provides manual layout and design of PCBs. 2.Personal computer uses with the software package	5 Sets	
2.1.4	Prototpye PCBs Production System LPKF-91 Antech Communication Co. (Thailand) ECAM Antech Communmication Co.	This system consists of two parts: 1.Machine for making PCB prototpyes This machine uses the milling and drilling process to produce copper routes on the PCBs. 2.Control terminal (Personal Computer with Hardware interface and Software)	1 Set	
2.1.5	Soldering Station MBT-201E PACE Inc.	The station consists of tools that are used in mounting and removing chips.	1 Set	

2. Electronic Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
2.1.6	Plotter	This is used for plotting PCB layouts. It should have the following features: -Supports up to A1 Size -Supports HP-GL Languages	1 Set	
2.1.7	Supporting Materials	-Models of Microprocessors -DSP chips -Specified-Purpose ICs -Specified-Purpose Sensors -Materials for PCB production -Micelleneous	1 Set	
	Equipments for Circuit Board Testing	the set of equipments are used for PCB testing process:		
2.1.8	Digital Storage Oscilloscope HP-54601A Hewlett-Packard Co.	-Bandwidth at least 100MHz -At least 4 Channels	4 Sets	
2.1.9	Function Generator HP-8116A Hewlett-Packard Co.	-Provides sine, square, triangle, ramp and pulse waveform -Provides frequency up to 50MHz -Supports AM, FM modulation -Provides output up to 20V -GPIB or HP-IB Supporting	2 Sets	
2.1.10	Logic Analyzer HP-1652B Hewlett-Packard Co.	-Timing Analysis Bandwidth>200MHz -State Analysis Bandwidth>80MHz	1 Set	
2.1.11	Data Generator HP-8175A;option 005 HP Company	This programmable data generator is used for generating pulse waveform	1 Set	
2.2	Microprocessor-Based Development system HP-64700 Hewlett-Packard Co.	This system consists of card frame, emulator/analyzer with following emulator card list: -AT&T DS032C -8086/8087 -8051,DIP -68000DIP -TMS320C25, PGA -Z80	1 Set	

3. Communication Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
3.1	Basic RF Communication Systems	This set of equipments consists of the equipments operating in RF range that covers Thailand's RF communication systems with the following items		
3.1.1	Signal Generator	-Frequency range from 100kHz to 3GHz -0.1Hz Frequency resolution -AM, FM Modulation -±0.1 dB level accuracy -Harmonics <-20dB	2 Sets	Hewlett Packard HP 8664A ADVANTEST R4262
3.1.2	RF Vector Network Analyzer	-Frequency range from 100kHz to 3GHz -Frequency resolution 1Hz -Output Power range from -20dB tp +5dBm	1 Set	Hewlett Packard HP 8752A ADVANTEST R3763A
3.1.3	Digital Power Meter	-2 or more channel -100kHz to 110GHz frequency range -Power range from -70 to +44dBm -Accuravcy ±1.2% worst case	1 Set	Hewlett Packard HP 437B
3.1.4	Frequency counter	-Frequency: 60MHz to 3GHz -Frequency resolution: 1Hz -Power measurement capability is an advantage	1 Set	ADVANTEST R5362A Hewlett Packard HP 5386A
3.1.5	High-frequency Analog Design Software Packages	-Linear and Nonlinear Analysis -S-parameter Device Library -GaAs MESFET Library -BJT Chip Library -Packed BJT Chip Library -RF Element Library -System Compoment Library	1 Set	EESof Incorporated EESof
3.1.6	EMC Measurement Systems	-Portable Spectrum Analyzer with 9kHz to 1.8GHz frequency range -Detector -Line impedance stabilization network -Transient Limiter -Two calibrated magnetic-field probes	1 Set	Hewlett Packard HP 84110B

3. Communication Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
		-Two standard antennas with automatic tracking systems -Tripod -Plotter		
3.2	Basic Data Communication Instruments			
3.2.1	Protocol Tester	-At least 80MB Hard disk storage -Physical Interface RS-232-C/C.24 RS-449/V.36 V.35 ISDN BRI: RJ-45, TAE8+4C ISDN BRI: RJ-45&Bantam, DB-9, RJ-14 -Up to 2.048 Mbps per test channel -Protocols ISDN X.25, Frame Relay SS #7 Group 4 Fax SNA/SDLC, ISO/HDLC	1 Set	Hewlett Packard HP PT500
3.2.2	Transmission Impairment Measuring Sets	-Level/frequency up to 110kHz -Signal-to-nise ratio -Phase and amplitute jitter -Three level impulse noise -Attenuation and delay distortion	1 Set	Hewlett Packard HP 4934A
3.2.3	Bit Error Rate Analyzer	-Interfaces: RS-232-C/V.24, V.35, ISDN -Data rates: 50bps to 2.048Mbps or higher -Cover wide range of test patterns	1 Set	Hewlett Packard HP 37732A ADVANTEST D3285 Tektronix CSA 907A
3.2.4	Vector Signal Generator	-Frequency range from 10MHz to 3GHz -BPSK, QPSK, 8PSK, 16QAM, 256QAM digital modulation -±0.1dB level accuracy	1 Set	Hewlett Packard HP 8780A

4. Instrumentation and Control System Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
4.1	Conrtrol system laboratory	The following equipments are used as simulated process for presenting the performance of desired control systems. The required specifications of these equipments can be summarized as follows: -The process must be enough complicated so that it will show true performance of control systems during the presentation. -The process should simulate the real process that are used in industries and must be constructed from industrial-type materials because this will make students familiar with true instruments in the industries.		This set of equipments is used in subjects in the areas of Control Engineering. There are several courses in which the equipments are used: -LE 304 Instrumentation and Control System laboratory -LE 331 Feedback Control systems -LE 432 Control systems -LE 433 Nonlinear Control systems -LE 434 Industrial Control and Instumentation -LE 436 Robot and Automation -LE 437 digital Control systems
4.1.1	Experimental process unit	-Constructed from industrial-type equipments -Provides more than 4 loops -Uses standard electrical control signal -Covers all basic industrial measurement (Pressure, Temperature, Flow, Level) -Simulates from real process in industries	1 Set	
4.1.2	Robotic unit	-At least 4 axis -0.1mm. accuracy -Electrical or elctro-pneumatic type -Uses optical encoder feedback in all axes -Combined with robot vision and sensing system	1 Set	
4.2	Signal Processing lab	The required equipments in this laboratory are general-purpose DSP boards and accessories that will be used in the study of digital signal processing algorithms, applications of DSP with several types of data		This set of equipments is used in the Digital Singnal Processing subjects and for supporting other subjects that have to analyze and process data in digital form. There are several courses in which

4. Instrumentation and Control System Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
		and evelopment of instruments that use DSP as processing unit.		the equipments are used: -LE 315 Signal and Systems -LE 437 Digital Control Systems -LE 438 Digital Signal Processing
4.2.1	General-purpose DSP board PCS/DSP32C or PCS/320C30 from LSI	-Uses 32 bit floating point DSP chip from TI, AT&T or Motorola -Provides 2 analog I/O channels with at least 12 bit resolution and 50kHz speed -At least 256KB memory on board -Uses with ISA or EISA bus -Provides high-speed data transfer connection -Combined with compiler, debugger and library	2 Set	
4.2.2	Accessory boards PC/CH4, PC/32DIO, PC/IMP32C PC/PA and PC/TEL32CS from LSI	This set of boards provides the additional functions for the DSP boards so that the use of DSP boards will expand to specific applications. This set of boards are listed as follows: -A/D and D/A board with 12 bit resolution and 100kHz speed -Digital I/O board -Frame grabber board -Audio board -Telephone board	1 Set	
4.2.3	DSP software package Hypersignal-Windows from Hyper-ception	This is a software package which has the following features: -Runs on PC -Time/Frequency Domain Analysis -Digital Filter Design -Real Time Spectrum Analysis and Digital Recording	1 Set	
4.2.4	Arbitrary waveform generator AG1200 from YOKOGAWA or HP8175A from Hewlett Packard or AWG5502 from Tektronix	-At least 10MSa/s synthesize speed -Capable to use mathematical function for program signal waveform -Graphical waveform programming -HP-IB or GPIB port	1 Set	
4.2.5	FFT Analyzer	-Frequency range from 0.1Hz to	1 Set	

4. Instrumentation and Control System Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
	TR9211C from ADVANTEST or HP35665A from Hewlett Packard or 2642A from Tektronix	100kHz -Spectrum, network and waveform analysis features -Supports programmable analysis functions -HP-IB or GPIB port		

4.4.1 Equipments for CNC Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.	Vertical Machining Center	1) Automatic tool cahnge with 30 Tools 2) Traverse (minimum) X 600mm. Y 400mm. Z 400mm. 3) Spindle Power ≧ 11Kw 4) Controller with latest technological features similar to Fanuc-15M 5) Simultaniour 3-axes 6) Accessories: a) Work holding devices like pneumatic vise modular fixture elements etc. b) Tool holder and cutting tools c) All standard accessories	1 Unit	1) Tool change system study 2) Big enough for cutting demonstration work piece (wider, longer but flat) 3) Enough for rough cutting 4) Follow the market of fanuc-Controller which booming in thailand a) High accuraracy positioning of the fixed work piece b) Very neccessary c) Included
2.	CNC Horizontal Machining Center	1) Automatic tool change with 30 tools 2) Automatic pallet changer 3) Simultanious-4-axes 3-Linear-1 rotary 4) Traverse (apprx) X 650mm. Y 450mm. Z 450mm. 5) Spindle power > 11Kw 6) CNC-controller the latest generation FANUC or OKUMA with built in tool management system Accessories: 1) Inspection measuring probe 2) Automatic tool offset measurement 3) Wok holding fixtures 4) Tool holder and cutting tools 5) All standrand accessories	1 Unit	1) Automatic changing of many tools study 2) The one of production technology which the IE-students would have been advising the works in industries after completion their study. 3) Better than the primitive one 4) Preperation for industrial service 5) More power consumtion 6) Suitable for research work, study and conducting specific courses of training for companies Accessories: All neccessary
3.	CNC Precision Surface Grinder	1) This machine could be used for high precision surface finishing work up to 1 micron. 2) Working table apprx. 200 x 400	1 Unit	1) For demonstrate the learner and let them hand on such a very fine production posibility 2) Proper size for CNC controlled

4.4.1 Equipments for CNC Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
		mm. with all neccessary standrad accessories 3) Magnetic paper filter 4) Controller 5) Automatic oil temperature regulator 6) Serveral types of form grinding wheels and balancing unit 7) Magnatic table 8) Blower unit for grinding dry workpiece 9) All standard accessories		machine 3)-9) Study the working principle of all standard equipments will increase the students experiences
4.	CNC TURNING CENTER (CNC TURN-MILL CENTER)	1) Min 3-axes (X,Z, and "C") 2) With rotary tools e.g. 6-fixed; 6-rotary 3) Chuck dia. ~250mm. (hydralic operated) 4) Strokes Xmin 300mm. Zmin~600mm. 5) With tailstock 6) Spindle moter ≧ 11Kw 7) Slant bed contruction 8) Turret preferably VDI-Type 9) Controller fanuc Accessories: 1) CNC-Controlled stedy rest 2) Automatic tool offset measurement with probes 3) Gantry robot for loading unloading the work pieces 4) Tool holders and cutting tools 5) All standard accessories	1 Unit	1) Study of the principle of the latest axes control system. 2) To study the driving system of the rotary tools holder 3) Appropriate size for 4) CNC macining center 5) To study how the automatic tailstock of machine can be controlled by programming 6) Appropriate power 7)-9) Very preferably machine feature in industries in Thailand. Accessories 1),2),3),4) Quit neccessary for study and research work. 5) Standard acc. normally included.
5.	CNC-EDM-Wire Cutting	-Overal size:1800 x 1000 x 1500mm. -Wire dia: 0.05-0.33mm -Max. wire feed rate:250mm/sec. -CNC control system closed loop -Allowing to use larger program (up to 1MB, approx 2500m of tape) -Automatic second cut function -Ability for cutting a different top and bottom shapes and defferent top and bottom radiaus -Semi-automatic wire take up device -All standrad accessories	1 Unit	Studying, researching technology transfering of wire cutting. technology should have been handing on the real and industrial size machine. Too small more diffcult to get the good quality of cutting the speciment (workpiece)

4.4.1 Equipments for CNC Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
6.	CNC-EDM-Sink Machine	-CNC controller -3-axes simultaneous maching full factory automation such as: a) Mirror/supper fine finish b) Orbital c) Automatic selection of m/c conditions multiple d) 'c'-axis machining e) Programable tool chang tooling kit f) Manual handle g) Dielectric-fluid temperature control unit h) Automatic tool changer i) Automatic dielectric fluid injection/suction j) A-axis unit k) All standrad accessories	1 Unit	The same result as wire cutting machine
7.	Robot and off-line Robotic Programming	1) Small size, lowcost, high speed 2) Articulated type 3) AC-servo drive with abolute position detection 4) Repeatability ±0.1mm. or better 5) Max. load capacity at wrist ≧ 5Kg 6) Application: -Abundant control function -High reliability achieved through NC mass production -Can be equiped with the software serve by high speed microprocessor for artifical 7) Off-line robot programming -High performance UNIX work-station -High speed automatic colision detection -Full scale 3-D shape modeling -Large capacity database managment	1 Unit	-Robot are being introduced into the factory in increasing numbers -Support the faculty in analysing the application of robots in the manufactoring industry -Machining/Machinery Handling/Flame-cutting/Cleaning/ Assembling/Handling moulding parts 7) Study the robot charatoristic and creation of application programs
8.	CNC-CMM (Co-ordinate Measuring Machine)	1) Manul/CNC Modes 2) Z spindle made by special meterial for overcoming thermal expansion. 3) At Z spindle using air balance	1 Unit	-Supporting the quality control of the workpiece produced by NC. machines-analyzing and solving a -Analyzing and solving a specific measurement problems by part

4.4.1 Equipments for CNC Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
		method 4) Hardware: HP. IBM personal computer and compatibles and Micropak 5) Software: Geopak, Scanpak, Statpak or others. 6) Measuring range X 700 Y 600 Z 600mm. 7) Resolution 0.0005mm or better 8) Guiding: air bearing 9) Table size: 900 x 1500mm >, MAT: granite flatness ≦ 20 micron. 10)Max. workpiece high ≧ 700mm. 11)Overalldim. W 1500 D 1800 H 2800mm. or better 12) With all standard Accessories		production -Too less specialist as well as engineer who know or study in depth concerning the quality control by means of using special equipment like CNC-CMM as we required

4.4.2 Equipments for CAD/CAM Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.	Computer Workstation	-64 MB main memory -1.44 MB Floppy Disk Drive -1.05 GB Hard Disk -At least 18 inch color monitor -Keyboard & mouse	4 Units	These equipments will be used for supporting CAD/CAM Laboratory which will upgrade the quality of engineering geaduates and enhance the research and development for CAD/CAM technology
2.	Personal Computer	-CPU is 486 intel -At least 50 MHz of speed -16 MB Memory -1.44 MB, 3.5 inch floppy disk drive -At least 120 MB hard disk -20 inch color monitor with super VGA card -Keyboard & mouse	10 Units	
3.	Tape Drive	-150 MB Cartidge Tape Drive		
4.	CD Rom Drive	Can be use to read software program form CD	1 Unit	
5.	Plotter	-Can use many colors and joint pencil togerther -A0 size	1 Unit	
6.	Laser Printer	-At least A3 size	1 Unit	
7.	Network Equipment	Network equipments are the equipments which can used connect total hardware is in CAD/CAM laboratory. They are consisted: -Ethernet hub can be upto 15 ports -Ethernet Card for 10 units PC -Communication software between computer workstation and Personal Computer	1 Set	

4.4.2 Equipments for CAD/CAM Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
8.	CAD/CAM Software for Workstation	The CAD Soft ware which the details are as follows: -Can be used to creat engineering drawing using standard geometric, such as points, lines, curves, circles and more -Dimension and Text capacities is Internation Standards Organization (ISO), JIS ANSI, DIN or user defined standards. -Can creates 3 demension design, construct, deform and blend complex, sculptured of the system. -To create complex solids from wireframe, surface or solid elements which are associative foe detail drafting -To analize mass properties, interference and general quality of design and machinability and then can perform interference chaecks between solids and/or polyhedral surfaces -The software has the function which users can interactively define many image parameters	1 Set	
8.	CAD/CAM Software for Warkstation (Continued)	The CAM Software which the detail are as follows: -Can be used control the NC-Machine, (Lathe, Drilling, Milling, Machining Center, Wire Cut and EDM) define tool paths for various opertions such as strating-ending, rough cutting, grooving, threading and tool changing -To simplify the machine tool programming process by simulating many poerations -To create NC-Programs directly from 2D and 3D which are created, in form of Automatically Programmed Tool (APT) source programs or Direct Cutting Location File (CLFILE) output		

4.4.2 Equipments for CAD/CAM Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
		-To visulize NC tool paths (on the Graphics screen) and simulated the movement of cutting tools -To provide the potion to perform contouring pocketing or surface machine in simple 2-axis or in complex 3-to 5-axis environments -This software can Interactively robots and robots cells by using a wireframe, surface or solid representation model and spacifying the appropriate joint types and their limits and then simulate the grasping or releasing of tools or objecs. In the other, it can calculate static loads on joints and show that robot is strong enough for a specfic task -Can create, modify and anslyze finite element models to evaluate a design -These datas are created by the software, can be transfered to IGES be standard data that other CAD/CAM system can use these data. Another wayis recieves the data of the others CAD/CAM -To store a wide varity of components for both 2D and 3D application and more.		
9.	CAD/CAM Software for Personal Computer	CAD software has the specification are as the following -Can use on PC which using intel 486 processor -To create engineering drawing using standard geometic (ISO, JIS, ANSI and more) and 3-dimension geometric models, to sculpt and shape models using NURB (Non Uniform Rational B-Spline) and Brizer surface, To verify and visualize designs using both faceted and smooth shading techniques and to docimen	10 Units	-To study for basic concept in creating the NC programming

4.4.2 Equipments for CAD/CAM Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
		designs for manufacturing and assembly by generating high-quality engineering drawings. -Can transfers and receives the data on DXF and IGES formats CAM software which the details are as follows: -To create tool path and NC program for CNC machine which is 2 1/2 axis and 3 axis, then simulates and show the working of cutting tools on the geometric desig -To create G-code which suitable for CNC controller is used -Can transfers and receives the data on DXF and IGES formats and download completed part programs directly to CNC machines.		

4.4.3 Equipments for Precision Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
1.	Central Measuring Network. Consist of :			Many Company in Thailand has set the metrology laboratories and try to up-grade the measurment method The "Central Measuring Net-Work" is one which would have been taught and transfered this measuting technology to the engineers and the related personel
1.1	Personal Computer		2 Sets	
1.2	Digimatic Instrument		1 Set	
1.2.1	Toolmaker Microscope with Video Image Edge Sensor	Like Mitutoyo (TM 301)	1 Set	
1.2.2	Digimatic Bench Micrometer	Measuring Range:0-5mm	1 Set	
1.2.3	Digimatic Indicator with Stand	Measuring Range:25mm	2 Sets	
1.2.4	Digimatic Depth Gauge	Measuring Range:0-150mm	2 Sets	
1.2.5	Digimatic Depth Micrometer	Measuring Range:0-150mm	2 Sets	
1.2.6	Digimatic Holtest	Dia.25-Dia. 30mm	1 Set	
1.2.7	Digimatic Height Gauge	With bidirectional touch signal probe. Measuring Range:0-300mm	1 Set	
1.2.8	Digimatic Caliper	Measuring Range 0-150mm 0-300mm	1 Set 1 Set	
1.2.9	Laser Scan Micro Meter	Measuting Range 0.3-30mm	1 Set	
1.2.10	Digimatic Micrometer	Measuring Range 0-25mm	1 Set	
1.2.11	Digimatic Screw Micrometer	Measuring Range 0-25 (60Deg.)mm Measuring range 0-25 (55Deg.)mm	1 Set 1 Set	
1.2.12	Digimatic Disc Micrometer	Measuring Range 0-25mm	1 Set	
1.2.13	Digimatic Gear Micrometer	Measuring range 0-25mm	1 Set	
1.2.14	Digimatic Inside Micrometer	Measuring Range 25-50mm	1 Set	
1.2.15	Digimatic Height Master	Measuring Range 10-310mm	1 Set	
2.	Digimatic Multi Unit	Receives data from upto six digimatic guage and performs GO/NG judgments on the measurement data individually or collectively	3 Sets	
3.	Micrometers			
3.1	Outside Micrometer Sets	Measuring Range:0-300mm (5pcs.)	1 Set	
3.2	Outside Micrometer Sets, Caliper	Measuring Range:0-300mm (5pcs.)	1 Set	
3.3	Screw Thread Micrometer, Fixed Anvil	Measuring Range:0-50mm (2pcs.)	1 Set	
3.4	Point Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.5	Crimp Height Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.6	Tube Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.7	Sheet Metal Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.8	Blade Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.9	Disc Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.10	Gear Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.11	V-Anvil Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
3.12	Side Milling Cutter Tooth	Measuring Range:0-50mm (2pcs.)	1 Set	
3.13	Wire MIcromenters	Measuring Range:0-50mm (2pcs.)	1 Set	
3.14	Hub Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	

4.4.3 Equipments for Precision Laboratory

No.	Item of Equipment	Specification	Amount Request	Utility
3.15	Groove Micrometers	Measuring Range:0-50mm (1pc.)	1 Set	
3.16	Limit Micrometers	Measuring Range:0-50mm (2pcs.)	1 Set	
4.	Gages and Others Equipments			
4.1	Small Hole Gages	Measuring Range:3-13mm	1 Set	
4.2	Telescoping Gages	Measuring Range:8-150mm	1 Set	
4.3	Optical Flats	Measuring Range:0.1um	1 Set	
4.4	Optical Flats	Measuring Range:0.2um	1 Set	
4.5	Micrometer Stands		4 Sets	
4.6	Dial Height Gages		2 Sets	
4.7	Dial Height Gages	Measuring Range:0-250mm	1 Set	
4.8	Depth Micrometer	Measuring Range:0-300mm	1 Set	
4.9	Vernier Depth Gages	Measuring Range:0-30mm	1 Set	
4.10	Dial Indicator		2 Sets	
4.11	Calibration Tester		1 Set	
4.12	Mini Magnetic Sands		1 Set	
4.13	Universal Magnetic Stands		1 Set	
4.14	Comparator Stands		1 Set	
4.15	V-Blocks		2 Sets	
4.16	Granite Surface Plates		2 Sets	
4.17	Square Gauge Block		1 Set	
5.	Roundness Tester	1) Incorporates powerful software with wide range of evaluation parameters 2) Roundness valuation notched workpiece measurement coaxiality and consentricity measurements. 3) Automatic tilt compensation function electrically align the axis of turn table and workpiece 4) Digital display of the Parameter Values 5) Optical Sensor Unit 6) Max workpiece standrs 7) Personal Computer is: -CPU is 486intel -At least 50MHz of speed -8MB Memory -1.44MB,3.5 inch floppy disk drive -At least 120MB hard disk -14 inch color monitor with super VGA card -Keyboard & mouse 8) Dot Printer 36 pin	1 Unit	

5.4 Equipment Requested from Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
1.	Structural Loading System Consists of: a) Loading System(1.1) b) Loading Frame(1.2-1.3) c) Measuring Equipment (1.4-1.7) d) Machinenary for Machine Shop(1.8-1.9)	As specified belows.	1 Set	The system shall be applied to study the structural behaviors of various kinds of structures and their parts under static and Dynamic load. The types of structures include Reinforced Concrete, Prestressed Concrete, Steel and Steel-Concrete Structures. The structures and their parts intended to be studied are as follows. -Prestressed Concrete Slab. -Frame and Truss -Beam, Column, Slab. -Actual Parts of Structure.
A) Loading System				As shown below
1.1	(a) Static Hydraulic Jack and Pumping Unit	-One 10tf with 200mm ram stroke(or more)Hydraulic Jack -One 100tf with 200mm ram stroke(or more)Hydraulic Jack -One 200tf with 200mm ram stroke(or more)Hydraulic Jack -One 500tf with 50mm ram stroke(or more)Hydraulic Jack -One Electric Hydraulic Pump with Minimum of 30 l/min Delivery Rate with Constant Different Pressure -Each Size of Male and Female Couplers must be Supplied with One 10m and One 5m Hoses for Connecting between Jack & Pump	1 Set	Applying load to structures or parts of structures
	(b) Dynamic Hydraulic Jack and Control Unit	-One 20tf with 200mm ram stroke(or more)Pulse Type Hydraulic Jack -One 50tf with 200mm ram stroke(or more)Pulser Type Hydraulic Jack -One Pulser Type Electric Hydraulic Pump with minimum of 30 l/min Delivery Rate -Each Size of Male and Female Couplers must be Supplied with	1 Set	Applying load to structures or parts of structures

5.4 Equipment Requested from Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
		One 10m and One 5m Hoses for Connecting between Jack & Pump		
	(c) Hollow Hydraulic Jack	-Two 10tf Hollow Hydraulic Jacks with about 40mm Displacement -One 30tf Hollow Hydraulic Jack with about 60mm Displacement -Two 2-Speed Hand Pumps for Low and High Flow of appr. 700 bar Max. Pressure supplied with Pressure Gauge -Male and Female Couplers of Jacks and Pumps must be Compatible, Connecting Hose should be about 2m in Length		Preparation of Specimens
	(d) Connecting Adaptors	Each Two Pieces of High Strength Adaptors with Both End Female Threaded Couplers for Connecting of: -6mm to 15mm Dia.Male Screw -9mm to 15mm Dia.Male Screw -15mm to 15mm Dia.Male Screw -19mm to 28mm Dia.Male Screw -22mm to 28mm Dia.Male Screw -25mm to 28mm Dis.Male Screw -28mm to 28mm Dia.Male Screw		Preparation of Speciments
B) Loading Frame				As shown below.
1.2	Self Supporting Steel Frame	Enable to withstand Multi-Loading Conditions i.e. -Column (appr. 4m Height with Cross Section of 400 x 400mm.) -Beam (appr. 6m Long 400mm Wide and 300tf-m Capacity) -Slab (appr. 3m x 6m in size and 40tf Capacity)	1 Set	Supporting and setting up for the loading test.
1.3	Electric Crane	Two Sets of 3tf, very Low Speed Electric Crane for Frame Assembling and Experimental Set up		
C) Measuring Equipment				
1.4	Load Cell	-Two Hollow Core 10tf Load Cells -One Hollow Core 50tf Load Cell	1 Set	Detect load of the actuator

5.4 Equipment Requested from Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
		-One 100tf Load Cell -One 200tf Load Cell -One 500tf Load Cell		
1.5	Data Logger	Computer Interface Data Logger -Strain Range Appr. +/-40000 x 1Exp - 6 -Input at Least 50 Points (Built-in at Least 10 Points) -Supplied with RS-232C Interface -One Internal Printer -Display At Least 20 Digits x 2Lines -Progammable Setting -With Self Diabnosis Functions -About 6000 Point Data Memory Protection -Measuring Speed 0.08 Sec/Point or Better -Programmable Timer -Automatic Scanning	1 Set	Detect stroke of the actuator
1.6	Displacement Tranducer	Strain Gauge Type Tranducer -10 pieces of 5mm Displacement -10 pieces of 10mm Displacement -10 pieces of 30mm Displacement -10 pieces of 50mm Displacement -10 pieces of 100mm Displacement -5 pieces of 200mm Displacement	1 Set	Control the actuator functions and movements
1.7	Dial Gauge	Indicator to 1/100mm Dial Gauge -2 Pieces of 5mm Displacement -2 Pieces of 10mm Displacement -2 Pieces of 30mm Displacement -2 Pieces of 50mm Displacement -2 Pieces of 100mm Displacement -2 Pieces of 200mm Displacement -10 Magnetic Base	1 Set	Control actuator movements
D) Machinery for Machine Shop				As shown below
1.8	Concrete Specimen Cutting Machine	-Power: > 3HP -Cutting Dpth > 200mm	1 Set	To cut the tested specimen
1.9	Portable Concrete Core Drill	-Run by Electricity -Core size: up to 200mm	1 Set	To drill the tested specimen
2.	Computer and Software	As specified belows	1 Set	The system shall be applied to study
2.1	Stuctural Analysis and Desig Software	Earthquake Analysis and Design on sun based Workstation	1 License	Structural Analysis
2.2	Personal Computer	IBM Compatible	5 Sets	Data Processor

5.4 Equipment Requested from Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
		-Intel 486 DX2-66 Based -VESA LOCAL BUS -8MB RAM -1.2MB FDD + 1.4MB FDD -Appr. 200MB HDD -17 in Super VGA noninterlaced Monitor & Super VGA Graphics Card		
2.3	Color Buble Jet Printer	-Up to A4 Size	1 Set	
2.4	Laser Printer	-A4 Size -Ram >= 2MB -Speed at least 8 Pages/min	1 Set	Report
3.	Instrument for Control Room of app. 4 x 7 x 4m	Consists of 2.1 and 2.2	1 Set	For curing concrete specimen
3.1	Cooling System	-20-27 Degree Celsius Controllable	1 Set	Temperature Control
3.2	Vaporizer and Humidity Controller	-In accordace with ASTM C31 -Pressure of Water: up to 6 bar -Water Atomising: app. 4 l/hr	1 Set	Humidity Control
4.	Universal Material Testing Machine with Servo Valve Control	Consists of 3.1 to 3.5	1 Set	The system shall be applied to study Mechanical Properties of Construction Materials
4.1	Loading Unit	- +/-20tf Dynamic Load - +/-30tf Static Load - +/-25mm Max. Stroke -Load and Stroke controllable -Strong Columns Loading Frame with Actuator at Top -Load Accuracy +/- 1% of Indicated Value -Complete with Stroke Detedctor and Load Cell	1 Set	
4.2	Load Cell	-One 20tf -One 5tf -One 500Kg. -Load Amplifier -Actual Load Type Load Calibration Device		
4.3	Hydraulic Power Supply	-Servo Valve Hydraulic Pump for 4.1	1 Set	
4.4	Computer Control System	-Interface for IBM Compatible Computer -Loading Wave Form: Standard: Sine, Triangular etc. User Define: Random etc.		

5.4 Equipment Requested from Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
		-Load and Stroke Control -Automatic Switching of Control Variables -Overload Protection at Mounting and Removing of Specimen -Safety device -Basic Loading Test Program -Fatique Test Program -Fatuque Bending Test Program		
4.5	Grip	-Splitflange Type Grip for up to 35mm Dia. Round Bar with Max. Dynamic Load of +/-20tf -Compression Plate Jig wit Max. Dynamic Load of -20tf -Non-Shift Grip for Plate Speciments without Bolt Holes for 0-20mm Thick Specimen with Max. Dynamic Load of 10tf	1 Set	
5.	Universal Testing Machine	Consists of 5.1 to 5.4	1 Set	The system shall be applied to study Mechanical Properties of Construction Materials in Compulsory Coarses
5.1	Loading Unit * UH 50B wide Type	-50tf Manual Control Universal Testing Machine -Appr. 80 Max. Loading Speed -Appr. 250mm Ram Stroke -Appr. 1200mm. Column to Column Distance -Appr. 800 x 650mm Effective Table Area -Digital Display and Analog Meter -Automatic Range Switching -Digital Load Display -Load Calibration Device		
5.2	Load Cell	-One 50tf -One 5tf -Load Amplifier -Actual Load Type Load Calibration Device		
5.3	Hydraulic Power Supply	-Suitable for 5.1	1 Set	
5.4	Grip * UH-B50	-Grip for Rods with 12-50mm Dia. -Grip for Plate with 0-45mm Thick -120mm Dia. Lower Compression	1 Set	

5.4 Equipment Requested from Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
		Plate		
	* 343-02376-02 and 343-02377-04	-20tf Grip for Therad Specimen		
	* 343-01833-01	-30-70mm Grip Face for Pipe Specimen		
	* 343-02783-03	-2tf Grip for Wood Specimen		
	* 343-00455-02	-120mm dia. Upper Spherical Compression Plate		
	* 343-02785-03	-10tf Compression Test Jig for Wood		
	* 343-02784-03	-10tf Bending Test Jig for Wood		
	* 341-17310-03	-2tf Shearing Test Jig for Wood Specimen		
	* 343-10025-13	-3tf Brinell Hardness Test Jig		
	* 343-02786-03	-0.5tf Grip for Plywood		
	* 343-02789-03	-Hardness Test Jig for Wood		

6.4.2 Equipment List

Group I

No.	Item of Equipment	Specification	Amount Request	Utility
1.	Liquid-Liquid Extraction System	This system is composed of two extractors with reciprocating-plate columns. The number of madreporite plates for each extractor is about 30. Four tubing pumps are needed as accessaries.	1	The reciprocating-plate columns have been found to be suitable for processing mixtures with emulsifying tendencies. This system will be used in "Chemical Engineering Laboratory 3". Two extractors are required. One is used for extracting operation while the other is used for regenerating solvent.
2.	Fluid-Solid Extraction System	A desktop type of supercritical gas extractor that can perform extraction process with supercritical fluid and a separation process from the fluid.	1	Supercritical gas has an excellent dissolubility to dessolve and extract a specific substance from a mixture. The supercritical gas extractor can be widely used in many fields and is very suitable for student-use laboratory due to its safety compared to other extractors. This system will be used in "Chemical Engineering Laboratory 3".
3.	Process Control Test Set	Consists of 3 level loops, 1 pressure loop, and 1 computer control loop. Equipments and specification in each loop are described in the Appendix.	1	Nowaday, a chemical engineer must be familiar with the basic building blocks of automatic control systems including transducers, transmitter or amplifiers, controllers, and final control elements. Moreover, he must also understand topics such as computer engineering, signal processing, and data communications etc. "The Process Control Set" will serve for this purpose.
4.	Continuous Plate Distillation Unit	A contnuous plate distillation unit with bubble cap tray column. The distillation column is made of glass and has a size of at least 10mm in diameter and 10 plates. Each plate has a nozzle for vapour or liquid sample take-off as well as temperature measurement. Also incorporated in this system	1	Plate distillation is the most basic type of distillation and is widely used in chemical industries in many ways, for example, the refinery of crude oil. Moreover, a distillation unit is a very good equipment for studying mass transfer. This equipment will be used in "Chemical Engineering

6.4.2 Equipment List

Group I

No.	Item of Equipment	Specification	Amount Request	Utility
		is the continuous take-off of buttom and distillate and re-feed by measn of dosing pumps. The distillation control console contains all necessary measuring and control devices for safe, exact, and reproducible operation of the unit.		Laboratory 2" and will give some concepts in scaling up to a pilot plant scale destellation unit.
5.	Batch Packed Distillation Unit	A batch packed distillation unit with vacuum system. The distillation column is more than 1m high and gas a diameter at least 15mm. The heating source is at least 500W of mantle heater. The control unit with a temperature recorder of a system is independent of the body.	1	In recent years, packed-column distilation units are widely used in the chemical industries due to its low pressure drop and low cost of operation. This unit will be used in "Chemical Engineering Laboratory 3" together with the continuous plate distillation unit, so that the students can see the difference between a distillation with plate column and that with packed column.
6.	Spray Dryer	A spray dryer with a nozzle injection feed system. The drying chamber has a diameter at least 450mm to make sure that the spray must be dried before reaching the chamber. The dryer can produce fine particle of 40-100 micrometre, and has a capacity for water evaporation at least 3 l/h. The collecting system is composed with a cone and a cyclone with an air draftler for drafting the product to the collecting pot. The nozzle has an automatic orifice cleanout system, and the drying chamber, cyclone, and the product vessel container are all made of superhard glass.	1	This equipment will mainly be used in the "Chemical Engineering Laboratory 2" for studying the drying phenomena, and in reseach in the field of heat and mass transfer. It can also be used for study of drying processyin order to develop the laboratory scale to the pilot or industrial scale.
7.	Stirred Liquid Phase Reaction Unit	A reaction unit consisting of a fermenter, a process control for controlling pH, DO, temperature, agitating and foaming, a control box, an aeration unit, two	1	Chemical reaction experiment is indispensible for chemical engineering education. One of the most important industrial reactor type is stirred liquid phase

6.4.2 Equipment List

Group I

No.	Item of Equipment	Specification	Amount Request	Utility
		microtube pumps, and other accessaries such as electrodes and joints. A fermentor has a capacity of 2.3.1, a water jacket in itself, a magneticallycoupled stirring shaft.		reactor. This unit facilitates a range of studies of reactor and reaction behaviours including homogenerous and gas/liquid reactions. It will be used in "Chemical Engineering Laboratory 2"
8.	Fluidized-bed Ractor	A fluidized-bed reactor consisting of a 2-litre fluidezed bed-fixed bed reactor, a pH controller, two microtube pumps, a peristaltic pump, and other accessaries such as flow arranging bulbs.	1	It has been found advantageous to carry out many solid-catalyzed reaction in fluidized beds. The circulation of the bed and the uniform agitation with in it presents the occurrance of dazed regions. In order to demonstrate this phenomenon, a fluidized-bed reactor system is necessary for chemical engineering students to perform such and experiment.
9.	Fixed-bed Reactor	A fixed bed reactor consisting of a 2-litre fluidized bed-fixed bed reactor, a pH controller, an aeration unit, a level controller, and two microtube pumps.		It has been recognized that enzymatic catalyzed reaction can be conducted by using immobilized carrier. This technique is suitable for expensive enzyme. Immobilized carrier can be operated as fixed-bed fashion in order to let chemical engineering students be familiar with fixed-bed reaction, this set of experiment is indispensible. Furthermore, it can show the differnce between two kinds of solid-catalyzed reactions; fixed-bed and fluidized-bed
10.	Stirrers Set	A set of 3 stirrers, and 24 propellers. Each stirrers has different stirring speed range; around 20-1,200rpm, around 10-600rpm, and around 5-300rpm. All stirrers are equipped with a control box that can show speed and torque in digital display. 24 propellers are of different type; 3 propellers for each type. All are 10mm in diameter and can		This stirrers set allows the studens to study the effect of many factors in stirring, such as type of propellers and stirring speed. This stirrers set be used in "Chemical Engineering Laboratory 1"

6.4.2 Equipment List

Group I

No.	Item of Equipment	Specification	Amount Request	Utility
		be used with the stirrers.		
11.	Drum Dryer	A drum dryer that can be used with steam pressure at least 5Kg/sq.cm. Drum size is 300-500mm. in both diameter and length. Accessaries such as knife and cake-receiving plates are also included.	1	Drum dryer is used to study the phenomena of drying process. It is one of the drying equipment usually used with the slurry or pastes. This set will be used in "Chemical Engineering Laboratory 2"
12.	Ball Mill Set	Consists of 1) 2 Ball-Mill Rotating Machines Each rotating machine has two lines and can rotate 240mm. Ball-Mill pots at the same time; 2 pots for each line. The maximum speed is at least 300rpm, and the minimum speed is not more than 200rpm. The tachometer may be separated from the machines. 2) 9 Stainless Steel Pots Dia. 90-100mm. x 4 Dia. 150-180mm. x 3 Dia. 300-320mm. x 2 3) 10 Forcelain Pots Dia. 90-100mm. x 4 Dia. 150-180mm. x 3 Dia. 240-300mm. x 1 4) HD Alumina Balls Dia. 10,15,20,25,30,40,50,60mm. 5Kg each 5) Glass Ball Approximate diameter 2.5,5,10, 15mm. 5Kg each. 6) Sieves and a sieve shaker Sieves has at least 45mm height. ASTM or JIS standard. 30 sizes; mesh sizes rangeing from felow 0.04mm to more than 5mm. A sieve shaker is an electromagentic drive approximately 3,000 oscillations per minute and can locate sieves mentioned above 7 sieves at the same time.	1	This ball mill set allows the sudent to study effect of various factors of ball mill unit, such as speed, pot size, and ball size. This set is used in "Chemical Engineering Laboratory I"

6.4.2 Equipment List

Group I

No.	Item of Equipment	Specification	Amount Request	Utility
		7) 2 Ultrasonic cleaning bath Contains heater and timer and has a shortest side longer than a sieve diameter mentioned above more than 3cm. 8) A sieve Cleaner An electrical brush for sieve cleaning.		
13.	Glassware for Analytical Chemistry Laboratory	This set contains glassware needed for Analytical Chemistry Laboratory such as desiccators, burettes and volumetric pipetters, for 60 students. Details are in the Appendix.		This set is planned for 2nd year students. It can be used in "Analytical Chemistry Laboratory" and "Physical Chemistry Laboratory" in the first and the second semester respectively.
14.	Glassware for Organic Chemistry Laboratory 60 sets	1 set at least contains 15 items of glassware that can composed to be assemblies such as vacuum distillation assemly, and an assembly with reflux, stirring, addition and drying. 1) 250ml round bottom flask 2) Plain stillhead 3) Liebing condensor 4) Bend adaptor with vacumm connection 5) 100ml pear shape flask 6) Plan column 7) Packing for plain cloumn 8) Allihn condensor 9) 100ml dropping funnel 10) Three-neck 250ml round bottom flask 11) 2 Drying tubes. 12) 450mm stirrere shaft (with blade) 13) Stopper 14) Cone/Screwcap Adapter 15) 5 Clips If not available, the allihn condensor can be eliminated.		It is the main equipment for Orgnic Chemistry Laboratory. Each items of each set can be composed to various assemblies such as vacuum distillation assembly, fractional distillation assembly, and an assembly with reflux, stirring, addtion and drying.
15.	Personnel Computors	A 486 PC.	3	For the department laboratories and administration.

6.4.2 Equipment List

Group II

No.	Item of Equipment	Specification	Amount Request	Utility
1.	X-ray Diffractometer	A fully automated X-ray powder diffractometer system consisting of more than 2kw X-ray generator, horizontal tube shield with 2 shutters, CPU controlled wide angle goniometer, scintillation counter, Cu X-ray diffraction tube, PC or 32-bit work-station that can run on MS DOS or MS EINDOWS 3.1, water-circulated chilling system, diffracted beam monochrometer qualitative analysis softweare, laser printer, and other necessary accessaries.	1	The X-ray diffractometer is a main analytical instrument that is widely used in all material laboratories. By this equipment the crystallinity of the substance can be studied. This equipment can be widely used by the chemical engineering students, especially in field of catalyst, in doing reserach as well as students in other departments such as industrial and civil engineering.
2.	X-ray Fluorescence Spectrometer	A sequential X-ray spectrometer consisting of X-ray generator, 5 analyzing crystal (LiF200, Ge, TAP, PET, LiF200 (PC)), 2 detectors; one for heavy elements, the other for light elements, 3kW X-ray target, standard software, fundamental parameter software, PC to use with the softwares, and other standard and needed accessaries.	1	This equipment is also a main analytical instrument. It can be used to determine both quantitative and qualitative analysis of nearly all elements for soild substances. It can serve all the departments in the Faculty because it can be used in many fields such as ceremics (glass and cement), steel, chemical and environmental engineering for chemical analysis.
3.	Ion-Chromatograph	Ion chromatograph is composed of the followings: degasser, high pressure delivery pump (i.e. 200 Kg/cm2), sample injection unit, temperature-controlled column oven, conductivity detector, and a data integrator.	1	Ion chromatograph is mainly used in biochemical and environmental engineering.
4.	Scanning Electron Microscope	A Scanning electron microscope with at least 100,000 times of magnification. This microscope has some automatic functions, for example an automatic function for focusing. This item also includes needed accessaries such as polaroid camera, image printer cool water recirculator and specimen preparing equipment.	1	This equipment is a microscope that has a magnification up to 300,000. It can be used in many fields such as in field of catalyst for chemical engineering, in field of concrete technology for civil engineering, and it can be used to study specimens of industrial and electrical engineering such as metals and ICs.

6.4.2 Equipment List

Group II

No.	Item of Equipment	Specification	Amount Request	Utility
5.	UV-Visible Spectrophotmeter	A UV-Visible spectrophotometer, consisting of a spectophotrometer main unit and a data processor unit. The main unit consists of a monochromator that has a resolution at least 0.15nm, for wavelength range 190-900nm. The data processing unit consists of a personal computer and other accessaries such as keyboard and mouse. Other fundamental accessaries such as a specular reflectance attachment (for using with a solid sample) are included in this system.	1	UV-Visible spectrophotometer is a very common analytical instument. It is used for study of photo absorbance in ultraviolet and visible range of the substances.
6.	Atomic Absorption Spectrophotometer	A flame/furnace dual application atomic absorption spectrophtotmeter that the burner and the furnace are housed in one compact unit and the switching between flame and furnace analysis can be done easily by software. This spectrometer has a system that automatically optimize the flame analysis condition. This item includes all needed fundamental accessaries.	1	Like an X-ray fluorescence spectrophotometer, atomic absorption spectrophotometer(AA) is also a chemically analysis instrument, but it is used for a solution sample. It is especially used in an analysis, both qualitative and quantitative, for heavy metal elements such as platinum and mercury of the sample. This equipment will mainly serve for chemical engineering students, and civil engineering students in field of environmental engineering.
7.	Gas Chromatograph	A computer-controlled gas chroma tograph with two injection ports. One of the injection ports is connected to the auto gas-sampling valve. There are two types of detectors in the system; FID and TCD. The sampling gas can be detected and analyzed by each detector at the same time. Both the injection ports and the detectors can be easily used with either packed or capillary column by only changing the adapter head. The injection mode can split the	1	Gas chromatograph is an analytical instrument that is used to identify the composition of a gas or volatile liquid sample. It can be used in nearly all of the students' laboratory in the Department. Moreover, it can be used in research in many field especially in field of petrochmecal engineering.

6.4.2 Equipment List

Group II

No.	Item of Equipment	Specification	Amount Request	Utility
		gas in the split ratio of 1:10 to 1:50.		
8.	Thermal Analysis Instrument	Stand-alone thermal analysis instruments including 4 thermal analyzers; differential scanning calorimeter (DSC), thermogravimetric analyzer(TG), differential thermal analyzer(DTA), and thermomechanical analyzer(TMA), interfaced with a system controller unit. Each thermal analyzer has its own operation functions including a detector, a temperature and gas control, and computer interface. A system controller consists of a controller and a personal computer. All needed fundamental accessaries are also included in this system.	1	Thermal analysis instrument is used to study property canges of a substance when it is treated with heat. It can be used widely in polymer and catalyst engineering. Also it is used to study phase transition of metals in field of industrial engineering.
9.	High Performance Liquid Chromatograph	High Performance Liquid Chromatograph (HPLC) is composed of the followings: degasser, high pressure delivery pump(i.e.200 kg/cm2), sample injection unit, pre-column, interchangable chromatogaphic column, temperature-controlled column oven, detector(i.e.variable wavelength UV-Vis unit), and integrator or data processor.	1	HPLC is popularly used in routine analysis and/or quality checking. It can be mainly used in field of biochemical, food, and environmental engineering.
10.	Fourier-Transform Infrared Spectrophotmeter	A fourier-transform infrared Spectrophotometer with softwares, a 32 bit computer, and other needed accessaries.	1	This equipment can be used in many fields of study on parts that concern with organic chemistry. Like atomic absorbance spectrophotmeter, this equipment will mainly serve for chemical engineering students and civil engineering students in field of environmental engineering.

7.4 Equipment Requested from the Japanese Government

No.	Item of Equipment	Specification	Amount Request	Utility
1.	Eddy Current Dynamometer	The capacity of dynamometer to absorb power must not less than 100hp	1	For the purpose teaching, research, and giving consultancy services.
2.	Exhaust Gas Analyzes	Portatble unit complete with analyzer units for CO, CO2, hydrocarbon, SO2, NOx. Data acquistion unit is included.	1	ditto
3.	Diesel Engine Fule Pump Test Set	The test set has the ability to perform the calibration, adjustment and testing of the distributor type pump of the 12-cylinder engine.	1	ditto
4.	Internal Combustion Engine Test Bed for Variable Compression Ratio	Four cylinder engine with the output power not less than 90hp and the electric dynamometer.	1	ditto
5.	Calorimeter for Determining the Capacity of the Air-Conditioning System with Capacity not Less than 3 TR	The test set consist of following -Indoor room with cooling coil, dehumidifer, humidifier, heating coil -Outdoor room with compresser, condenser -Air duct system -Measuring insturments and control	1	ditto
6.	Steam Power Plant Test Set Complete with Data Acquisition System	The test set has the electrical power output of not less than 1KW	1	ditto
7.	Gas Turbine Plant Test Set Complete with Data Acquisition System	The test set has the electrical power output of not less than 5KW	1	ditto
8.	Pneumatic Control System		1	ditto
9.	Hydraulic Control System		1	ditto
10.	Textbooks, Videotapes and Standards in Mechnical Engineering		1	For the Faculty of Engineering library

資料－6　カリキュラム

COURSE PLANNING FOR ELECTRICAL ENGINEERING STUDENTS

First Year

Course Number	Title	Credits
	Semester 1	
LE 121	Computer for Engineers	2
CE 102	Introduction to Engineering	1
ME 111	Engineering Drawing I	2
SC 124	Chemistry for Engineers I	4
SC 133	Physics for Engineers I	4
MA 101	Mathematics I	3
EL xxx	English Course x	3
	Total	19
	Semester 2	
IE 121	Material Science I	3
IE 158	Engineering Tools & Operations	2
ME 112	Engineering Drawing II	2
MA 102	Mathematics II	3
SC 125	Chemistry for Engineers II	2
SC 134	Physics for Engineers II	4
EL xxx	English Course x	3
	Total	19

Second Year

Course Number	Title	Credits
	Semester 3	
LE 201	Basic Electrical Engineering Laboratory	1
LE 211	Electrical Circuit Analysis	3
LE 221	Digital Circuit Design	3
IE 261	Engineering Statistics	3
CE 202	Engineering Mechanics I	3
AE 211	Thermodynamics I	3
MA 203	Mathematics III	3
	Total	19
	Semester 4	
LE 212	Basic Electronic Circuits and Devices	3
LE 242	Electromechanical Energy conversion I	3
ME 221	Engineering Mechanics II	3
ME 241	Mechanics of Fluids I	3
MA 204	Mathematics IV	3
MA 305	Numerical Methods	3
	Total	18

Third Year

Course Number	Title	Credits
	Semester 5	
LE 202	Electromechanical Energy Conversion Laborator I	1
LE 301	Electronic Circuits Laboratory	1
LE 302	Electromechanical Energy Conversion Laboratory II	1
LE 311	Measurement and Instrumentations	3
LE 312	Network Theory	3
LE 313	Electronic Circuits	3
LE 314	Physics Electronics	3
LE 341	Electromechanical Energy Conversion II	3
LE 351	Electromagnetics Theory	3
	Total	21
	Semester 6	
LE 303	Telecommunication engineering Laboratory	1
LE 304	Instrumentations and Control systems Laboratory	1
LE 322	Microprocessors	3
LE 331	Feedback Control Systems	3
LE 352	Principles of Communications	3
LE 353	Communication Networks and Transmission Lines	3
LE xxx	Technical Electives	3
ME 391	Fundamentals of Mechanical Engineering	3
	Total	20
LE 305	Industrial Training (Not less than 240 hours)	0 credit

Fourth Year

Course Number	Title	Credits
	Semester 7	
LE 401	Project I	2
LE 441	Power Systems	3
LE xxx	Technical Electives	3
LE xxx	Technical Electives	3
IE 201	Engineering Management	3
IE 302	Engineering Economy	3
TU xxx	Social Sciences Electives	3
	Total	20
	Semester 8	
LE 402	Project II	3
LE xxx	Technical Electives	3
LE xxx	Technical Electives	3
TU xxx	Humanities Electives	2
xx xxx	Free Electives	3
	Total	14

COURSE PLANNING FOR INDUSTRIAL ENGINEERING STUDENTS

First Year

Course Number	Title	Credits
	Semester 1	
LE 121	Computer for Engineers	2
CE 102	Introduction to Engineering	1
ME 111	Engineering Drawing I	2
MA 101	Mathematics I	3
SC 124	Chemistry for Engineers I	4
SC 133	Physics for Engineers I	4
EL xxx	English Course x	3
	Total	19
	Semester 2	
IE 121	Material Science I	3
IE 158	Engineering Tools & Operations	2
ME 112	Engineering Drawing II	2
MA 102	Mathematics II	3
SC 125	Chemistry for Engineers II	2
SC 134	Physics for Engineers II	4
EL xxx	English Course x	3
	Total	19

Second Year

Course Number	Title	Credits
	Semester 3	
IE 201	Engineering Management	3
IE 261	Engineering Statistics	3
LE 241	Introduction to Electrical Engineering	3
CE 202	Engineering Mechanics I	3
AE 211	Thermodynamics I	3
MA 203	Mathematics III	3
TU xxx	Social Sciences Electives	3
	Total	21
	Semester 4	
IE 222	Material Science II	3
IE 263	Experimental Design	3
CE 221	Mechanics of Solids I	3
ME 221	Engineering Mechanics II	3
ME 241	Mechanics of Fluids I	3
MA 204	Mathematics IV	3
MA 305	Numerical Methods	3
	Total	21

Third Year

Course Number	Title	Credits
	Semester 5	
IE 231	Industrial Safety	3
IE 302	Engineering Economy	3
IE 311	Work Study	3
IE 351	Manufacuring Process & Technology I	3
IE 362	Quality Control	3
IE 444	Environmental Control	3
	Total	18
	Semester 6	
IE 303	Industrial Cost Analysis & Budgeting	3
IE 332	Value Engineering	3
IE 352	Manufacturing Process & Technology II	3
IE 353	Automation	3
IE 354	Basic Instrumentation	3
IE 364	Operations Research I	3
IE xxx	Technical Electives	3
	Total	21
IE 390	Industrial Training (Not less than 180 hours)	0 credit

Fourth Year

Course Number	Title	Credits
	Semester 7	
IE 412	Production Planning & Control	3
IE 413	Project Feasibility Study	3
IE 433	Industrial Plant Design	3
IE 492	Industrial Engineering Project I	1
IE xxx	Technical Electives	3
ME 302	Mechanical Engineering Laboratory I	2
IE 331	Tool Engineering	3
	Total	18
	Semester 8	
IE 494	Industrial Engineering Project II	2
IE xxx	Technical Electives	3
IE xxx	Technical Electives	3
TU xxx	Humanities Electives	2
xx xxx	Free Electives	3
	Total	13

COURSE PLANNING FOR CIVIL ENGINEERING STUDENTS

First Year

Course Number	Title	Credits
	Semester 1	
LE 121	Computer for Engineers	2
CE 102	Introduction to Engineering	1
ME 111	Engineering Drawing I	2
MA 101	Mathematics I	3
SC 124	Chemistry for Engineers I	4
SC 133	Physics for Engineers I	4
EL xxx	English Course x	3
	Total	19
	Semester 2	
IE 121	Material Science I	3
IE 158	Engineering Tools & Operations	2
ME 112	Engineering Drawing II	2
MA 102	Mathematics II	3
SC 125	Chemistry for Engineers II	2
SC 134	Physics for Engineers II	4
EL xxx	English Course x	3
	Total	19

Second Year

Course Number	Title	Credits
	Semester 3	
CE 202	Engineering Mechanics I	3
CE 231	Concrete Technology I	2
LE 241	Introduction to Electrical Engineering	3
IE 201	Engineering Management	3
IE 261	Engineering Statistics	3
AE 211	Thermodynamics I	3
MA 203	Mathematics III	3
	Total	20
	Semester 4	
CE 201	Civil Engineering Laboratory	1
CE 211	Surveying I	3
CE 221	Mechanics of Solids I	3
ME 221	Engineering Mechanics II	3
ME 241	Mechanics of Fluids I	3
MA 204	Mathematics IV	3
MA 305	Numerical Methods	3
	Total	19

Third Year

Course Number	Title	Credits
	Semester 5	
CE 311	Surveying II	3
CE 321	Structural Analysis I	3
CE 351	Soil Mechanics I	3
CE 371	Hydrology	2
CE 372	Hydraulic Engineering I	3
ME 322	Mechanics of Solids II	3
TU xxx	Social Sciences Electives	3
	Total	20
	Semester 6	
CE 322	Structural Analysis II	3
CE 331	Reinforced Concrete Design I	3
CE 341	Construction Engineering & Management	3
CE 352	Soil Mechanics II	3
CE 361	Highway Engineering	3
CE 362	Highway Materials	2
CE 373	Environmental Engineering	3
	Total	20
CE 399	Industrial Training on Civil Engineering (Not less than 200 hours)	0 credit

Fourth Year

Course Number	Title	Credits
	Semester 7	
CE 312	Engineering Geology	3
CE 421	Timber and Steel Design	3
CE 431	Reinforced Concrete Design II	3
CE 291	Seminar	1
CE xxx	Technical Electives	2
CE xxx	Technical Electives	3
IE 302	Engineering Economy	3
	Total	18
	Semester 8	
CE 499	Civil Engineering Project	3
CE xxx	Technical Electives	3
CE xxx	Technical Electives	2
TU xxx	Humanities Electives	2
xx xxx	Free Electives	3
	Total	13

COURSE PLANNING FOR MECHANICAL ENGINEERING STUDENTS

First Year

Course Number	Title	Credits
	Semester 1	
LE 121	Computer for Engineers	2
ME 111	Engineering Drawing I	2
CE 102	Introduction to Engineering	1
MA 101	Mathematics I	3
SC 124	Chemistry for Engineers I	4
SC 133	Physics for Engineers I	4
EL xxx	English course x	3
	Total	19
	Semester 2	
ME 112	Engineering Drawing II	2
IE 121	Material Science I	3
IE 158	Engineering Tools & Operations	2
MA 102	Mathematics II	3
SC 125	Chemistry for Engineers II	2
SC 134	Physics for Engineers II	4
EL xxx	English Course x	3
	Total	19

Second Year

Course Number	Title	Credits
	Semester 3	
ME 201	Basic Mechanical Engineering Laboratory	1
LE 201	Basic Electrical Engineering Laboratory	1
LE 211	Electrical Circuit Analysis	3
IE 201	Engineering Management	3
IE 261	Engineering Statistics	3
CE 202	Engineering Mechanics I	3
AE 211	Thermodynamics I	3
MA 203	Mathematics III	3
	Total	20
	Semester 4	
ME 202	Automotive Technology	2
ME 221	Engineering Mechanics II	3
ME 241	Mechanics of Fluids I	3
LE 212	Basic Electronic Circuits and Devices	3
CE 221	Mechanics of Solids I	3
MA 204	Mathematics IV	3
MA 305	Numerical Methods	3
	Total	20

Third Year

Course Number	Title	Credits
	Semester 5	
ME 302	Mechanical Engineering Laboratory I	2
ME 322	Mechanics of Solids II	3
ME 323	Mechanics of Machines	3
ME 331	Thermodynamics II	3
ME 342	Mechanics of Fluids II	3
IE 358	Manufacturing Process	3
TU xxx	Social Sciences Electives	3
	Total	20
	Semester 6	
ME 303	Mechanical Engineering Laboratory II	2
ME 313	Mechanical Design I	3
ME 324	Mechanical Vibrations	3
ME 332	Heat Transfer	3
LE 202	Electromechanical Energy Conversion Laboratory	1
LE 242	Electromechanical Energy Conversion I	3
TU xxx	Humanities Electives	2
ME xxx	Technical Electives	3
	Total	20
ME 304	Industrial Training (Not less than 6 consecutive weeks)	0 credit

Fourth Year

Course Number	Title	Credits
	Semester 7	
ME 405	Mechanical Engineering Laboratory III	2
ME 406	Projects Seminar	0
ME 414	Mechanical Design II	3
ME 425	Automatic Control System	3
ME 433	Refrigeration and Air Conditioning	3
ME 434	Power Plant Engineering	3
IE 302	Engineering Economy	3
	Total	17
	Semester 8	
ME 407	Mechanical Engineering Project	3
ME 435	Internal Combustion Engines	3
ME xxx	Technical Electives	3
ME xxx	Technical Electives	3
xx xxx	Free Electives	3
	Total	15

COURSE PLANNING FOR CHEMICAL ENGINEERING STUDENTS

First Year

Course Number	Title	Credits
	Semester 1	
LE 121	Computer for Engineers	2
CE 102	Introduction to Engineering	1
ME 111	Engineering Drawing I	2
SC 124	Chemistry for Engineers I	4
SC 133	Physics for Engineers I	4
MA 101	Mathematics I	3
EL xxx	English Course x	3
	Total	19
	Semester 2	
IE 121	Material Science I	3
IE 158	Engineering Tools & Operations	2
ME 112	Engineering Drawing II	2
SC 134	Physics for Engineers II	4
AE 101	Physical Chemistry	4
MA 102	Mathematics II	3
EL xxx	English Course x	3
	Total	21

Second Year

Course Number	Title	Credits
	Semester 3	
AE 201	Mateiral and Energy Balance I	2
AE 211	Thermodynamics I	3
LE 241	Introduction to Electrical Engineering	3
IE 201	Engineering Management	3
CE 202	Engineering Mechanics I	3
MA 203	Mathematics III	3
AE 203	Analytical chemistry	4
	Total	21
	Semester 4	
AE 202	Material and Energy Balance II	2
AE 212	Chemical Engineering Thermodynamics	3
CE 221	Mechanics of Solids I	3
ME 221	Engineering Mechanics II	3
ME 241	Mechanics of Fluids I	3
MA 204	Mathematics IV	3
AE 204	Organic Chemistry	4
	Total	21

Third Year

Course Number	Title	Credits
	Semester 5	
AE 303	Fundamentals of Heat Transfer	3
AE 304	Fluid Analysis	3
AE 321	Chemical Engineering Unit Operation Design I	3
AE 322	Chemical Engineering Kinetics and Reactor Design	3
AE 381	Chemical Engineering Laboratory I	1
IE 261	Engineering Statistics	3
IE 302	Engineering Economy	3
	Total	19
	Semester 6	
AE 305	Fundamentals of Mass Transfer	3
AE 323	Chemical Engineering Unit Operation Design II	3
AE 324	Chemical Engineering Reactor Design	3
AE 382	Chemical Engineering Laboratory II	1
AE xxx	Technical Electives	3
MA 305	Numerical Methods	3
TU xxx	Humanities Electives	2
	Total	18
AE 391	Industrial Training (Not less than 180 hours)	0 credit

Fourth Year

Course Number	Title	Credits
	Semester 7	
AE 425	Chemical Engineering Unit Operation Design III	3
AE 426	Process Dynamics Control	3
AE 427	Chemical Engineering Plant Design	3
AE 428	Biochemical Engineering	3
AE 492	Chemical Engineering Seminar	1
AE xxx	Technical Electives	3
TU xxx	Social Sciences Electives	3
	Total	19
	Semester 8	
AE 493	Chemical Engineering Project	3
AE xxx	Technical Electives	3
IE 231	Industrial Safety	3
xx xxx	Free Electives	3
	Total	12

資料－7　ﾀｲ国の概要

1．自　然

位　置　　北緯 5～21 度、東経 97～106 度
面　積　　51万3,115 km²、ﾊﾞﾝｺｸ首都圏面積 1,565.2 km²
気　候　　ﾊﾞﾝｺｸの気候
　　雨　　期　　6 ～ 10月、乾　　期　　11 ～ 5月
　　気　　温　　最高 40℃、最低 15℃
　　年平均湿度　　73.0％
　　年間降水量　　1,360mm、　年間降雨日数　120日

2．人　口（1992年）

総人口　　5,779万人、人口密度　113人／km²、人口増加率　1.5％
ﾊﾞﾝｺｸ　　人口　555万人、人口密度　3,546人／km²

3．民族・言語・宗教

民　族　　ﾀｲ族が約 8割、華人約 1割
　　その他 ﾏﾚｰ人、ｶﾝﾎﾞｼﾞｱ人、ｲﾝﾄﾞ人、ﾍﾞﾄﾅﾑ人、山岳民族
公用語　　ﾀｲ語
宗　教　　仏教 95％

4．政　治

政　体　　1932年から立憲君主制
　　現国王ﾌﾟｰﾐﾎﾟﾝ・ｱﾃﾞｭﾝﾔﾃﾞｰﾄ陛下はﾁｬｸﾘ王朝 9世
国　会　　上・下院の二院制
内　閣　　1992年 9月ﾁｭｱﾝ・ﾘｰｸﾊﾞｲ（民生党首）が首相に就任

5．経 済

近年の経済指標

			1987	1988	1989	1990	1991	増加率（1980-91年平均）
人 口		千 人	53,605	54,469	55,448	55,801	56,679	1.8 %
GNP	総 額	百万ﾄﾞﾙ	45,664	54,487	67,586	79,044	89,548	7.8 %
	一人当り	ﾄﾞﾙ	850	1,000	1,220	1,420	1,580	5.9 %
経常収支		百万ﾄﾞﾙ	-365	-1,655	-2,498	-7,282	-7,564	
財政収支		百万ﾊﾞｰﾂ	-28,294	14,913	54,732	99,360	118,414	
対外債務残高		百万ﾄﾞﾙ	17,071	16,365	17,066	17,545		
D S R		%	21.0	18.8	16.3	17.0	13.1	
外貨準備		百万ﾄﾞﾙ	5,212	7,112	10,509	14,273	18,416	
為替レート		年平均 1USﾄﾞﾙ=ﾊﾞｰﾂ	25,723	25,702	25,702	25,585	25,547	
消費者物価指数		(85年=100)	104.4	108.4	114.2	121.0	127.9	

出 所：我が国の政府開発援助1993年（外務省）

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