フィリピン共和国
マニラ航空保安大学校
航空管制技術官育成計画プロジェクト
長期調査報告書

調査期間
1997年6月9日～6月27日

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資料

第１章　長期調査員の派遣

１－１　派遣の経緯と目的

フィリピン国では急速な経済成長に伴って航空旅客・貨物の輸送が急増しており、その安全性確保で緊急の政策課題になっている。このため我が国による円借款をはじめ諸外国の援助で、航空保安施設や主要空港の整備が全国的に進められてきたが、これら施設を適切に運用・維持管理していくためには、航空関係者の技術力向上が不可欠である。

同国では1978年に、国連開発計画（UNDP）の援助で、航空関係の高等教育機関として、マニラ航空保安大学校（CATC）が設立された。しかし政情不安等から1988年に援助が停止され、教育・訓練用機材も老朽化して、現在はほとんど機能しておらず、空の安全を守る航空管制技術官などの人材育成が著しく立ち遅れていた。そこでフィリピン国政府はCATCを活性化するため、無償資金協力による機材整備と、航空管制技術官を育成するプロジェクト方式技術協力を、我が国に要請してきた。

これを受けて国際協力事業団は、1997（平成９）年１月に事前調査団を派遣して技術協力要請の背景、要請内容を確認するとともに、プロジェクト基本計画案の策定を行った。

今般の長期調査は、本「フィリピン共和国マニラ航空保安大学校航空管制技術官育成計画」のプロジェクト・デザイン・マトリックス（PDM）の作成、カリキュラム開発及びプロジェクト実施計画案を取りまとめることを目的とする。またカリキュラム開発に資するため、フィリピン国の大学工学部の現行カリキュラム及び教育実態を調査する。

１－２　調査員の構成

(1) 訓練計画（Training Planning）

佐藤　洋　　運輸省航空局 管制保安部無線課 無線技術調整官

(2) 管制施設（Air-ground Communication and Radar Facilities）

岩崎一成　　運輸省大阪航空局 岡崎航空路監視レーダー事務所 主任航空管制技術官

(3) 航空保安無線施設（Air Navigation Facilities）

大坪　守　　運輸省航空局 管制保安部無線課 係長

(4) 協力企画（Cooperation Planning）

牧野　修　　国際協力事業団 国際協力総合研修所 国際協力専門員

1－3　調査日程

日順	月日	行程	行動内容	調査員
1	6/9 (月)	東京－ﾏﾆﾗ JL741便	移動、JICA事務所打合せ	牧野
2	6/10 (火)		大学調査 (Polytechnic University of the Philippines, University of the East)	同上
3	6/11 (水)		大学調査 (FEATI University, Mapua Institute of Technology)	同上
4	6/12 (木)	ﾏﾆﾗ-ﾀﾞﾊﾞｵ PR811便	移動、ﾀﾞﾊﾞｵ空港調査	同上
5	6/13 (金)	ﾀﾞﾊﾞｵ-ｾﾌﾞ PR410便	移動、ﾏｸﾀﾝ空港調査、大学調査 (San Carlos University)	同上
6	6/14 (土)		資料整理	同上
7	6/15 (日)	ｾﾌﾞ-ﾏﾆﾗ PR856便	移動、資料整理	同上
8	6/16 (月)	東京－ﾏﾆﾗ JL741	移動、JICA事務所打合せ、日本国大使館表敬、大学調査 (University of the Philippines)	佐藤、岩崎 大坪、牧野
9	6/17 (火)		マニラ自宅航空保安大学校(CATC)にて協議	同上
10	6/18 (水)		CATCにて協議	同上
11	6/19 (木)		CATCにて協議	同上
12	6/20 (金)		CATCにて協議	同上
13	6/21 (土)		調査員打ち合わせ	同上
14	6/22 (日)		資料整理、ﾒﾓﾗﾝﾀﾞﾑ案作成	同上
15	6/23 (月)		運輸通信省航空局(ATO)にてタニエガ局長と協議、CATCにてメモランダム案作成	同上
16	6/24 (火)		CATC施設視察、運輸通信省(DOTC)表敬	同上
17	6/25 (水)	ﾏﾆﾗ－東京 JL742便	ATOにてﾀﾆｴｶﾞ局長とﾒﾓﾗﾝﾀﾞﾑ署名、交換 JICA事務所、大使館報告、移動 (佐藤)	同上
18	6/26 (木)		ﾏﾆﾗ国際空港調査、電子機器販売店調査	岩崎、大坪 牧野
19	6/27 (金)	ﾏﾆﾗ－東京 JL742便	JICA事務所、大使館報告 移動	同上

1－4　主要面談者

＜フィリピン側＞

Maj.Gen.Carlos F.Tañega(RET)	Director General ATO, DOTC
Cesar T. Valbuena	Assistant Secretary for Planning, DOTC
George D. Esguerra	Director III Transportation Planning Service, DOTC
Reynaldo D. Fernando	Director CATC
Sadiri Q. Agarpao	Chief, Academic Br. CATC
Herman A. Cunada	Director's staff, CATC
Bienvenido Romero III	Chief, Management, CATC
Renato Santos	Chief ANS Adominstration, ATO
Jesus Llamas	Supervising ANS Specialist, ATO
Reynaldo Jimenez	Assistant Chief, Air Traffic Controller, ATS, ATO
Toshiji Abe	JICA Expert, ATO
Reynaldo B. Vea	Dean, College of Engineering, University of the Philippines
Jonathan L. Salvacion	College Secretary, College of Engineering, UP
Prof. Gedaria	Dean, Polytecnic University of the Philippines
Prof. Marzan	Dean, University of the East
Prof. Ugalde	Vice President, FEATI University
Prof. Masil	Dean, Mapua Institute of Technology
Prof. Odulio	San Carlos University
Michael U. Laher	Actg. Airport Manager, Davao
Manuel S. Ibabao	Chief, Air Nav. Specialist, Davao
Hector Nabua	Supervising ANSS, Davao
Nilondio S. Pepito	ANSS Specialist II, Davao
Alex Gines C. Bolor	ANSS Specialist II, Davao
Romio Bersonda	Cheif Operation, Mactan, Cebu International Airport Aurthority
Elmer Leones	ANSS Specialist, Mactan
Sheila Colina	ANSS Specialist, Mactan

＜日本側＞

小谷野喜二	在フィリピン日本国大使館 一等書記官
後藤　洋	JICAフィリピン事務所 所長
奥田　久勝	JICAフィリピン事務所 所員

第2章　要約

長期調査では、「フィリピン共和国マニラ航空保安大学校航空管制技術官育成計画」のプロジェクト・デザイン・マトリックス(PDM) 作成、カリキュラム開発及びプロジェクト実施計画案の取りまとめを目的として、調査及び協議が行われた。その結果、日本、フィリピン双方が理解し合意した事項をMEMORANDUM OF UNDERSTANDING（資料1）に取りまとめ、署名を取り交わした。

調査は、調査員から事前にフィリピン国運輸省航空局（ATO）及びマニラ航空保安大学校（CATC）にQuestionnaire（資料2）を送り、これへの回答を得ていたので、それをもとに協議が順調に行われた。

これにより、プロジェクトは1997年10月1日から2002年9月30日の5年間にわたって行われることで合意された。

第３章　プロジェクト・デザイン・マトリックス（PDM）の作成

まず、国際開発高等教育機構(FASID)作成のプロジェクト・サイクル・マネージメント(PCM)教材（英文）を使い、フィリピン側関係者にプロジェクト・デザイン・マトリックス(PDM)の考え方を知ってもらうための短時間のセミナーを行った。フィリピン国の空の安全にかかわる様々な阻害要素を問題系図にし、そこから目的系図を導き出し、プロジェクトのスコープの確認を行った。また、事前調査で協議されたPDM案のプロジェクトの上位目標（Overall Goal)、目的(Project Purpose)、成果（Outputs)、活動（Activities)に関し、再確認した。さらに、今回新たに指標（Objectively Verifiable Indicators)、それらの指標データ入手手段（Means of Verification)、外部条件（Important Assumption）及び両者の投入（Inputs）についてフィリピン側と協議し、PDMの第２稿として作成した（資料３参照)。

PDMを使ったプロジェクト管理手法につき、フィリピン側参加者から非常に高い評価を与えられた。以下、PDMに関する協議の主要な点を列記する。

３－１　指標（Objectively Verifiable Indicators)

上位目標、プロジェクト目標及び成果に関する指標をそれぞれ協議し、上位目標に対しては航空保安無線施設等の運用上の障害時間が明らかに減少すること、プロジェクト目標に対しては400人の航空管制技術官（ANSS)が専門コースの研修を受けること、三つの成果に対してはそれぞれ、①1998年12月までに研修に必要な教材が開発されること、②13名のインストラクターが訓練を受けること、③２年目から毎年10の専門コースが実施されることで合意した。

３－２　指標データ入手手段（Means of Verification)

運用上の障害時間は現場からの報告書及びNOTAM、航空管制技術官400名の訓練はマニラ航空保安大学校（CATC）の記録から、また、成果についてもCATCの記録から入手することで合意した。

３－３　外部条件（Important Assumption)

外部条件についてはフィリピン国の事情を考慮し議論された。その結果、上位目標が達成されるためには、①従来型の航法援助施設が近代化されること、②それらのスペアパーツの現場への供給が確保されること、及び③ANSSが適正に配置されることが外部条件として必要であることとした。プロジェクト目標が達成されるためには、訓練を受けた航空管制技術官が運輸省航空局（ATO）の業務に継続して従事すること、また、三つの成果が得られるためにはインストラクターがフルタイムでCATCで継続して教育・指導に従事することが外部条件として必要であると確認された。プロジェクトを開始するための前提条件（Pre-conditions）としては、訓練用機材の税

関手続きや国内輸送が大幅に遅れないことが確認された。

3－4　活動（Activities）

活動内容に関しては前回事前調査時の各項目を確認するとともに、今回の各大学工学部カリキュラム調査の結果、多くの大学の工学部電子・通信コースで航空航法援助システムを教えていることが判明したため、その教科を教えている大学教官をCATCに集め、航空航法援助システムに関するセミナーを開催することを当方から提案した。協議の結果、この項目を「Activities 2－5」として新たに追加することに合意した。

第4章　プロジェクト実施計画案の策定

4－1　プロジェクト期間

協議の結果、プロジェクト期間は1997年10月1日から2002年9月30日までの5か年間とすることで合意された（資料1 ANNEX 2 参照）。

4－2　合同委員会（Joint Committee Meeting）の設立

プロジェクトの円滑な実施のため、年1回程度開催される合同委員会の設置を当方より提案し、資料1 ANNEX 3 に示すような委員会をプロジェクト開始とともに設置することで合意した。

ただし、議長（Chairperson）について当方は運輸省航空局（ATO）タニエガ局長を考えている旨を述べたところ、タニエガ局長の意見として両国代表の合同議長制（Co-chair）で行いたい旨の発言があった。

4－3　フィリピン側の投入

はじめに、航空機の円滑かつ安全な運航は100%航空保安施設等による地上からの支援に依存する時代にあって、フィリピン国で近代化されつつある施設の信頼性の確保と確実なサービスの提供のために必要な人材の育成は、フィリピン国空域の航空機の安全運航と円滑な航空交通流の確保にとって極めて重要であり、その人材育成の役割を果たすマニラ航空保安大学校（CATC）のインストラクターには有能な人材が必要であること、従ってカウンターパート（C／P）の任命は本プロジェクトの命運を決する重大な事柄であることを当方から伝え、慎重に人選することを要請した。

協議の結果、現状ではインストラクターになり得るベテランは施設の増加に比べて少ないため、現場から一度にその多くをCATCに引き上げることは難しい等、フィリピン側の事情を踏まえて、1名のプロジェクトマネージャーと13名のインストラクター及び2名の事務職員をプロジェクトに常時配置することで合意された。これらのうち、プロジェクトマネージャーとインストラクターはCATCにおける常勤であること、またインストラクターのうち、チーフインストラクター1名と少なくとも四つの専門コース（ILS、VOR、DME、Radar）担当の各代表インストラクター（4名）は現場での経験があり訓練経験者であること、また残りの8名のインストラクターは現場での経験のない若手をプロジェクトに配置するが、プロジェクト期間中に現場での経験もさせ、インストラクターとして育成していくことを条件とすることで合意した。

今回、カウンターパートのリストはフィリピン側の準備不足で用意できなかったが、9月に予定されている実施協議の時までにリストを用意することとなった。

プロジェクト実施にあたって必要となる運営経費、訓練経費、訓練機材の保証期間後の保守経

費等のフィリピン側負担の予算について協議し、これらが既に予算化されていることを確認した。(資料1 ANNEX 4－1、4－2参照)。

専門家が執務する部屋、訓練室、受講者の寮についても現場を見ながら確認し、次の要望事項を述べた。

(1) 専門家執務室はCATCフェルナンド校長と協議し、1階インストラクター室と同一のエリアとし、少なくとも4人のカウンターパート（常任教官）も同室とすることが効果的である旨提言。また、必要な電話、デスク、チェア、ロッカー等についてはプロジェクト開始までに準備を整えるよう要請。

(2) 訓練室について、本プロジェクト関連事項として無償資金協力供与資機材配置計画案に基づいて検討を実施し、窓側への機器配置の是非（外部からの雨滴等進入の危険性）、研修効率上のILSの配置再検討（GS[Glide Slope]、LLZ[Localizer]の分離設置）、エンジンの設置環境再検討（現在の倉庫を仕切って設置する計画であるが、廊下側の壁構造上防音対策が必要）等、実習室環境整備について提言。帰国後JICA無償スキーム担当者と調整することとした。

4－4　日本側の投入

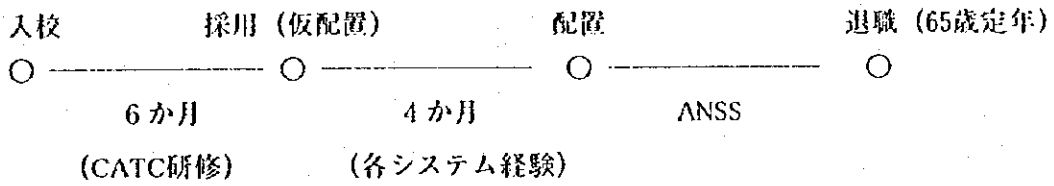
日本人専門家について、長期派遣（1年以上）の専門分野はチーフアドバイザー（Air traffic enginnering）1名、Air navigation system 1名、Radar system 1名及び調整員1名の4名、さらに、短期派遣（1年未満）については専門分野及び時期は必要に応じ協議しながら各年度ごとに決めていくことで合意された。

フィリピン人カウンターパートの日本での研修は、毎年数人が航空保安大学校、航空保安現場、航空航法援助装置の製造工場などで2週間程度行うことを日本側から提案し、その時期や人数については各年度ごとに両者で協議のうえ、決定することで合意された。

供与機材（技協分）に就いても年度ごとにその必要性を協議しながら、その内容を決めていくことで合意された（資料1 ANNEX 5－1、5－2参照)。

第５章　カリキュラム開発

航空管制専門官（ANSS）研修コースの見直し・改善に際しては、事前調査等をもとにフィリピン国航空管制技術官のライフサイクルを勘案した研修体系とし、そのうえでコースの設定が必要であることから、同国の航空管制技術職員の保守方式・保守体制等についての現場聞き取り・実態調査を実施したところ、保守対象施設・保守方式・ツール・体制について基本的には旧来の我が国の場合と似通っているが、ライフサイクルについてはおおむね次のように確認できた。



この間、必要な教育は採用前の６か月間のANSS研修の他は、少数の者がインストラクターのための研修や国外研修を修了しているが、現場経験にのみ頼らざるを得ない状況であり、本来必要なトレーニングがされていない。

このことを踏まえて日本側から資料４．ANSS研修体系を提案し、基本的にフィリピン側の理解を得、今後これに沿って検討をすすめ更に具体化することで合意した。

提案の「ANSS研修体系」は、①従来の６か月間の研修を基礎研修と位置づけ、対空通信、NDBの保守業務に対応しうる内容とする。②専門性をシステムごとに区分し、スペシャリスト養成のための専門コースを新設する。このコースは再研修にも対応させる。③さらに将来的には教官・管理者等指導者の養成コースの設置を検討するというものであり、これを基にカリキュラム開発を行うこととした。

研修体系提案に先だって実施した現場のANSS聞き取り等調査概要は次のとおり。

(1) 新規採用職員訓練用の基礎コース（現行６か月コース）と新規設定の専門研修コース（再研修を含む）の各カリキュラム開発のために、基礎的な職務分析と受講者の資質に関する情報収集を行った。

(2) 職務分析は、資料５．Questionnaire to ANSSに基づき、現場のANSSに対する聞き取り調査等により行った。

(3) ANSSの担う職務は セブ・マクタン国際空港を例に見ると、組織が六つのセクションに分けられ、①AFC（Air Facility Complex）では19名のANSSがVHF受信機、UHFリンク、多重録音装

置、レーダーデータ処理装置、移動無線機を、②Mactan Transmitterでは6名がVHFとUHFの送信機を、③Mactan NAV-AIDSでは12名がNDB、ILS、DVOR/DMEを、④レーダーでは8名がターミナルレーダー、SSRを、⑤Mt. Majicでは10名がVHFの送受信機、UHFリンク及びレーダーエンルートを保守整備している。第6番目のセクションであるElectro-Mechanicalではスタンバイエンジン（発動発電機）や滑走路照明灯（航空灯火）等の保守を行うが、ここにはANSSは配置されていない。

(4) ダバオ国際空港の場合、NAV/AIDS、タワー及び送信局の三つの組織のもと、それぞれ7名のANSSが配属され、DVOR/DME、ILS、NDB、VHF、UHFなどの装置を保守整備している。ここでもスタンバイエンジンや滑走路・タクシーウエーの照明灯などの保守にはANSSはかかわらない。

(5) ANSSの勤務形態は、24時間3勤交代で週5日勤務である。

ANSSが現場で行う保守業務は担当する機器について、毎日清掃し、メーターを読み、記録する予備保守を基本に国際民間航空機関（ICAO）の標準に定められた週ごと、月ごと、半年ごと及び1年ごとに行う手順に従って保守することになっている。

現在、障害の原因が分かった場合、カード単位で交換する余裕がないため、できるだけコンポーネント単位で交換するようにしているとのことであるが、予備部品の供給体制が十分機能していないことが現場のANSSの不満であった。

今後、導入される最新型の航法援助装置や通信装置は、カード交換による保守が主流となるであろうから、マニラ航空保安大学校（CATC）のカリキュラム開発においてもこの点に留意する必要があるものと思われる。

一方、受講生の資質を調査するため運輸省航空局（ATO）の最近5年間の新規採用者の出身校（資料6参照）を調べ、それらの教育内容を資料7に基づき調査した。

これらの基礎情報を基に、基礎コースと専門コースの訓練内容及び訓練方法について協議した。

5－1　基礎（Fundamental）コース

ATOは新規採用者をANSSに育てるために、CATCにおいて6か月間の基礎コースを実施している。最近はほぼ毎年、30名近くを訓練している。CATCが最近行った大学卒の志願者に対する入学試験問題は資料8に示すような内容である。

現行のCATCの基礎コースのカリキュラムを調査したところ、大学工学部の卒業生に対する研

修としてはあまりにも初歩的な科目、例えば、6か月720時間のうち、直流回路27時間、電子デバイス36時間、交流回路30時間など、既に大学で履修しているはずの科目に多くの時間が割かれている（資料9参照）。この点についてCATC側は大学によって教育には大きな差がある。しかも、実技実験が十分でないことが多い。また、機械工学を専攻した学生が入ってくることもあり、このような基礎的科目を再度教える必要があるとのことであった。

今回、大学での調査で判明したことは、フィリピン国の工科系大学のカリキュラム（資料10参照）はTechnical Panel for Engineering, Architecture and Maritime Education（資料11参照）に一応沿った形ではあるが、実際は国立フィリピン大学やJICAなどから援助を受けている国立大学を除いて、ほとんどの大学では学生の数に比べ実技実験を十分に行える環境にないのが実情である。例えば、10～15人の学生が一緒に一つの実験を行うことがあるという。学生数が増加する一方で実験の施設や機器が十分でないためである（資料12参照）。したがって、CATCで行っているこれらの基礎的科目を特に実験を重視して行うことは、必要なことなのかもしれない。

しかしながら、CATCでの実験方法はすべてトレーナーによるものであることが分かった。市販のトレーナー及び付属の教科書を使うことによりインストラクターは特に実験指導書を開発する必要もなく、インストラクターにとってはありがたいが、変化させるパラメーターが少なく、回路を学生に組ませたり各種の計測機器を接続させるなどの作業が少ないため、創意工夫する能力を開発することができず、教育的効果は少ない。

また、基礎科目の後の伝送路、アンテナ、通信回路などの専門科目に実験機器や計測機器が全くなく、理論だけを教えているのは基礎コースの大きな問題点といえる。

したがって、基礎コースについては現行のトレーナーでの実習に加え、例えば、ある目的を実現するための回路を設計し、その回路を組み、計測器でデータを取り、その結果を考え、工夫させるような課題を与えるような科目が必要であろう。このような課題への学生の取り組み方からANSSとしての適性が相当判断できるものと思われる。

幸いに、無償資金協力で供与される機材の中に、基礎コースで使える計測機器などがあるため、これらを十分に活用できる実験実習課題を考慮すべきである。

さらに、本プロジェクトで専門科目を受けることになる既に現場で経験のあるANSSの多くが、アナログの知識はあるがデジタルの知識とコンピュータを扱った経験の少ないことが現場での調査で分かった。この点についてはATO及びCATCでも同意見であった。したがって、専門コースを受ける前にデジタル技術及びパーソナルコンピュータ技術を習得させることは必須条件である。

フィリピン側は上記の6か月の基礎コースのカリキュラム見直し、及びデジタル技術とコンピュータに関するカリキュラムの開発に日本側のアドバイスを求めている。専門コースの研修効果を高めるために基礎コースの充実は不可欠である。

5－2　専門（Specialized）コース

本専門コースは、基礎研修修了者を対象としてシステムごとのスペシャリストを養成するために新設するものであり、無償資金協力で供与される教育用機材のうち4種類の機材に関連して次の4コースを設けることとしている。また、これらのコースは、当分の間は現場に配置されているANSSの再研修のためのコースとしても活用するものであり、本プロジェクトの目的を達成するための中核をなすコースである。

① ILS専門研修
② VOR専門研修
③ DME専門研修
④ RADAR専門研修

各専門研修の内容は座学及び実技からなるが、今回の調査でフィリピン側と協議するなかで、再研修を必要とする現場ANSSは、アナログ回路の知識はあるものの、最近のデジタル素子を使用した電子回路及びコンピュータの知識を習得している者が非常に少ないことが判明した。また、数は少ないが情報処理システムの運用・保守もANSSによって実施されていることと、今後導入されようとしている各種航空保安無線施設は保守ツールとしてパーソナルコンピュータを使用する機器が順次増加する傾向にあること等から、各専門家研修のコースに次のようなカリキュラムを盛り込むこととした。

特に再訓練を受講する現場からのANSSに対するこれら研修の必要性が強く求められているのを感じるとともに、フィリピン側の専門研修への期待の強さがうかがわれた。

(1) デジタル回路の基礎

期間：各専門研修コースの実施に影響を与えない範囲で、おおむね20時間程度のカリキュラムを実施したい。

内容：教育用機材で使用される半導体についての動作概要及び実際に使用される電子回路の一部をブレッドボード上に再現させ、動作を把握させる等。

(2) コンピュータの基礎

期間：デジタル回路の基礎と同様、おおむね20時間程度のカリキュラムを実施したい。

内容：マイクロプロセッサー概論、プログラミング概論及びコンピュータシステム概論等。

また、フィリピン側から機器の実習においては、供与される各種測定器の使用法について十分な研修を実施する必要がある旨の要望があった。その理由として最近の測定器は、

① コンピュータ内蔵方式化
② デジタル化

③　従来の測定器に比較して高機能化

④　高価格化

していることがあげられ、測定器の機能を十分活用するための実技指導が必要とされた。

今後専門コースにおけるカリキュラムの作成時には、上記要望を考慮しながらフィリピン側と十分協議する必要がある。

5－3　ANSS研修コース年間計画

日本側から資料13の提案を行った。提案にあたっては我が国の航空保安大学校での航空管制技術官教育実績を参考とし、またフィリピン国側の特性も考慮し、基礎コース18週間、引き続き行うA／G、NDBコース6週間、施設の設置状況の大要からVOR、DMEコースは年間各3回、ILS、レーダーコースは年間各2回の延べ10コースとした。また、期間はレーダーが9週間、他のコースは各5週間である。

提案内容についてフィリピン側は、各基礎コース35名程度、各専門コース10名の研修者を充てることで回数もおおむね適切であると基本的に理解したので、これに基づいて協議を進めた。

ANSSの出身校カリキュラム等調査結果、6か月の現ANSSコースの入試・カリキュラムの内容を検証しつつ協議した結果、提案の基礎コースとA／G、NDBコースは統合し、期間も含めて現6か月コースの内容を見直すこととした。また、カリキュラムの詳細検討に至らなかったこと、フィリピン側から内容の追加要望があったこと等から、各専門コースの期間については日本側の提案の内容を精査した上で、再度協議・調整することで合意した。見直しに際しては、資料14、15の施設の整備状況、ANSS要員の配置状況を将来を含めて勘案のうえ、検討することが必要である。

第６章　留意事項

６－１　合同委員会

設置については既にフィリピン側と合意を得ているが、この合同委員会に必要があれば経済開発庁（NEDA）の関係者を招くこともあり得ることを、今後提案するべきであろう。

６－２　カウンターパートの任命

プロジェクト実施にあたり最重要の課題であり、プロジェクトの成否を決めるものといえる。適任者がカウンターパートに任命されるよう、適宜プロジェクトの進捗状況を運輸省航空局（ATO）局長に報告できる体制を作ることが必要であろう。

６－３　我が国の支援体制

プロジェクト実施に際しては、その期間中に現地では入手し難い情報の収集、あるいは処理が難しい要件の発生等も予想されるが、そのために日本国内に必要な支援体制を確保しておくことが必要であろう。

第７章　その他

本技術協力と連携した無償資金協力による供与機材としてフィリピン国政府から導入要請があった航空保安業務支援システム（ANMS）は、無償資金協力の基本設計調査、技術協力の事前調査を踏まえて導入を検討してきたが、必要性は理解されたものの使用計画が十分把握できないとして、今回の無償供与機材の中で導入を決定するに至らなかったものである。

このため、本調査のカリキュラムの検討の中で使用計画を明らかにすることとしていたが、今回の行程の中でカリキュラムの内容を協議するに至らなかったことから、帰国後のカリキュラムの検討とともに使用計画を検討することとしている。

本報告にも触れているとおり、計画している基礎コース、専門コースとも限られた範囲で、できる限りの研修効果を上げる必要があるが、本機材は航空機の運航・管制運用に関する研修ツールとして、またFANS構想構築に向けての新CNS/ATMの教育等々、短期間での研修効率上有効な機材であることから、更なる検討課題としたい。

資　　料

MEMORANDUM OF UNDERSTANDING

Supplementary Study on The JICA Technical Cooperation Project
"Upgrading Human Resource Development
for Air Navigation Systems Specialist
at the Civil Aviation Training Center Manila"

The Supplementary Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") visited the Philippines from the 9th to 27th June 1997, for the purpose of implementing supplemental study to follow up the previous preliminary study last January, 1997 for the Upgrading Human Resource Development for Air Navigation Systems Specialist at the Civil Aviation Training Center Manila (hereinafter referred to as "the Project"), under the JICA Technical Cooperation Program.

During its stay in the Republic of the Philippines, the Team had exchanged views and discussed with the Philippines authorities regarding the concrete and detailed matters in the questionnaire which the Team prepared for the smooth implementation of the above-mentioned the Project.

As a result of the review and discussions, the Team and the Air Transportation Office, Department of Transportation and Communications confirmed and agreed on some points referred to in the document attached hereto. The list of participants is also attached.

Manila, 25th June, 1997

Osamu Makino
Supplementary Study Team
JICA

M/GEN. Carlos F. Tañoga (Ret.)
Assistant Secretary
Air Transportation Office
DOTC

THE ATTACHED DOCUMENT

1. Project Design Matrix (PDM)
The process of formulation of PDM was explained by the Team and the PDM for the Project formulated on 20th June, 1997 (Attachment 4 to Minutes of Discussions, Preliminary Study signed on 20th January, 1997) was reviewed and studied. Objectively verifiable indicators, means of verification, important assumption and inputs from Japan and from the Philippines in the PDM were discussed. As a result of discussions, the PDM was formulated as attached in Annex 1.

2. Duration of the Project
It was agreed that the Project duration would be from 1st October 1997 to 30th September, 2002. The tentative 5-year Project schedule is attached in Annex 2.

3. Establishment of Joint Committee
It was agreed to establish a Joint Committee for the Project. The Joint Committee shall provide fundamental policies based on the PDM and overall guidance to the Project. The organization of the Joint Committee is attached in Annex 3.

4. Assignment of Counterparts (C/P)
It was agreed to assign one project manager and 13 counterparts who will work with Japanese experts entire period of project implementation. It is desirable that they should have work experiences in the fields. The list of the project manager and C/P personnel will be prepared by the time of implementation survey scheduled in September, 1997.

5. Counterpart budget for the Project
It was confirmed that ATO had already prepared the necessary counterpart budget for implementing the Project as attached in Annex 4.

6. Training courses
As a project purpose, 400 ANSSs are to be trained in the Project period. To attain this purpose, 10 training courses per year are to be conducted. The details of the training courses will be finalized as soon as the Project starts.

7. Japanese experts
The fields of the Japanese experts will cover Air traffic engineering, Air navigation engineering and Radar engineering. The Japanese experts will provide C/P with technical guidance to conduct special courses; ILS, VOR, DME and Radar, and

Fundamental courses including A/G communications Equipment, Digital technique and Computer basic training.

8. C/P training in Japan
C/P training in Japan will be carried out at Aeronautical Safety College, manufacturers of air navigation equipment, ACC and airport facilities.

9. Equipment provision
For the technology transfer from Japanese experts to C/P instructors, some equipment will be provided upon the request from the Philippine authority. The items requested are listed as attached in Annex 5.

List of participants

Reynaldo D. Fernando	Director, CATC
Sadiri Q. Agarpao	Chief, Academic Br. CATC
Hernan A. Cunada	Director's staff, CATC
Bienvenido Romero III	Chief, Management, CATC
Renato Santos	Chief, ANS Administration, ATO
Jesus Llamas	Supervising ANS Specialist, ATO
Reynaldo Jimenez	Assistant Chief, Air Traffic Controller, ATS, ATO
Hiroshi Sato	ATS Dep. CAB, MOT, Japan
Kazunari Iwasaki	Osaka CAB, MOT, Japan
Mamoru Otsubo	ATS Dep., CAB, MOT, Japan
Osamu Makino	Institute for International Cooperation, JICA
Toshiji Abe	JICA expert, ATO

Project Design Matrix (second draft) formulated on June 20, 1997

Project name: Upgrading Human Resource Development for ANSS at the CATC Manila Duration: October 1, 1997 to September 30, 2002

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal In the Philippines, the facilities for air traffic navigation and communications are operated, maintained and managed properly therefore the safety of the air traffic is increased and aircraft is navigated efficiently.	Duration of operational outage of NAV/COM/Surveillance will be significantly reduced.	1. Operational Outage reports 2. NOTAM	Renewal of conventional systems in the field Supply of spare parts guaranteed Appropriate ANSS allocation
Project Purpose Training courses for ANSS are improved therefore sufficient number of highly qualified ANSS are produced.	400 ANSSs trained	CATC record	ANSSs continue working for ATO.
Outputs 1. In the training courses for ANSS, appropriate curriculum and teaching materials are developed. 2. Highly qualified instructors are produced for the training courses for ANSS. 3. The training courses for ANSS are properly managed.	1. By the time December 1998 necessary teaching materials developed 2. 13 instructors trained 3. 10 training courses per year to be conducted	CATC record	Instructors continue working for CATC on the full time basis.
Activities 1-1 A working group is set up for development of curriculum and teaching materials. 1-2 Systematic training courses are designed for ANSS. 1-3 Training courses are conducted for curricula and training materials development members. 1-4 A curriculum is developed for each course. 1-5 Training materials are developed for each curriculum. 1-6 Training materials are properly maintained and updated. 2-1 Criteria of instructors are made to qualify an ability of an instructor. 2-2 Instructor training programs are planned. 2-3 Instructor training programs are accomplished. 2-4 A training manual for an instructor is developed. 2-5 Seminars for university lecturers in Air Navigation Systems are held. 3-1 Instructors are well organized. 3-2 Annual training schedule is staged. 3-3 Trainees are screened. 3-4 Courses are accomplished. 3-5 Courses are evaluated. 3-6 On the job training (OJT) program is planned, accomplished and evaluated. 3-7 New technology (CNS/ATM, etc.) is studied. 3-8 The latest Air Navigation Systems Technology is introduced to related courses.	Inputs [The Philippines side] 1. Personnel 1 Project Manager 2 Administrative staff 13 Instructors 2. Costs of operation, training, maintenance for facilities and training equipment after warranty service 3. Office space for experts 4. Training facilities 5. Student accommodation [Japanese side] 1. Personnel Long-term expert 1 Chief adviser (Air traffic engineering) 1 Coordinator 1 Air navigation engineering 1 Radar engineering Short-term experts as necessity arises 2. C/P training in Japan 3. Equipment provision		Custom clearance and transport procedures for training equipment do not become significantly delayed.

ANNEX 1

Tentative schedule of Implementation Plan for the project of

"Upgrading Human Resource Development for ANSS at the CATC Manila"

June 1997

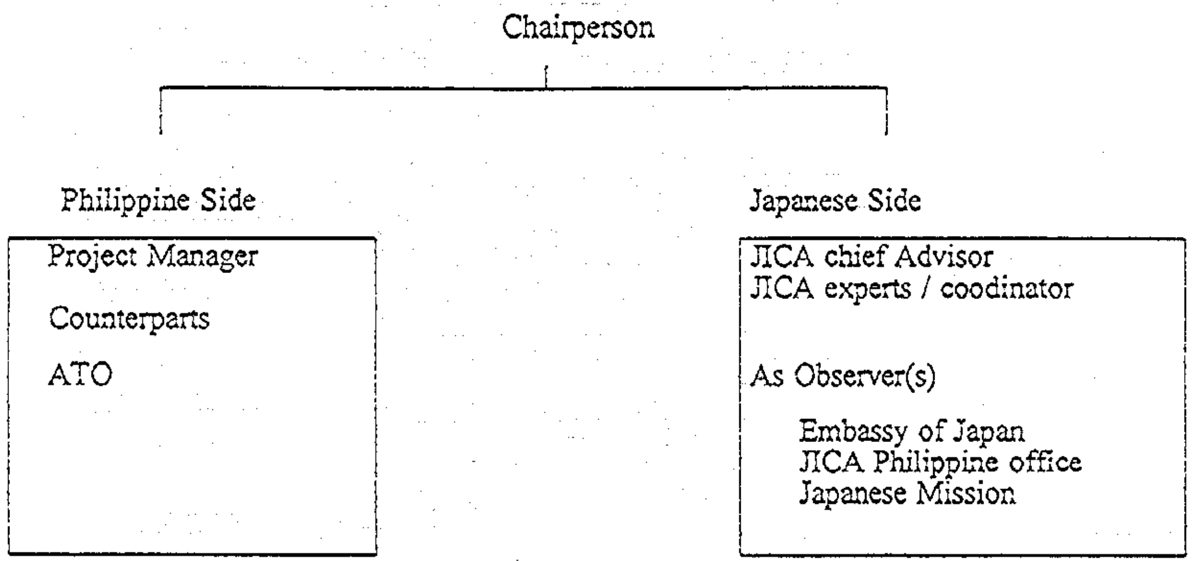
Input / Fiscal Year	1997/10 - 1998/03	1998/04 - 1999/03	1999/04 - 2000/03	2000/04 - 2001/03	2001/04 - 2002/03	2002/04 - 2002/09	Remarks
Annual Order	1st Year	2nd Year	3rd Year	4th Year	5th Year		
Duration of Technical Cooperation	Oct.1 -1997					Sept.30 -2002	
Japanese side 1.Fields of the Japanese experts 1-1)Long-term expert a.Chief Advisor (Air traffi engineering) b.Air Navigation engineering c.Radar engineering d.Coordinator							
1-2)Short-term expert							Speciality and Date of dispatch in details are determined upon deliberation in every year
2.Counterpart training in Japan	*	*	*	*	*	*	Date of training and number of counterpart in details are determined upon deliberation in every year
3.Provision of equipment	*	*	*	*	*	*	Detais are deliberated in every year
4.Dispatch of Survey Teams		△ Planning and Consultation Team		△ Advisory Team (Mid term valuation)		△ Final evalua-tion	Mark" △ "stands the schedule of the dispatch of the Mission
Philippines side 1. Assignment of counterparts 2.Local running costs							Budget: *Euipment maintenance cost; *Teaching matterials production cost; *trainee's allowance; *cost related to expert

ANNEX 2

ANNEX 3

June 1997

Tentative draft of Joint Committee Meeting for the project of
"Upgrading Human Resource Development for ANSS at the CATC Manila"



ANNEX 4-1

PROPOSED TRAINING AND SEMINAR EXPENSES CY - 2000

	COURSES	DURATION	NUMBER OF PARTICIPANTS	PER DIEMS P400/DAY	AIR/LAND TRANSPORTATION ALLOWANCE	HONORARIUM FOR INSTRUCTIONS P100/HOUR	TRAINING MATERIALS	TOTAL
1	Basic Airways Technician	16 weeks	30	1344000		33600	39,000.00	1377600
2	DME Maintenance	8 weelks	25	560000	195,000.00	16800	19,500.00	771800
3	VOR Maintenance	12 weeks	25	840000	195,000.00	25200	19,500.00	1060200
4	ILS Maintenance	12 weeks	28	940800	195,000.00	25200	19,500.00	1161000
5	ATC Maintenance	12 weeks	25	840000	195,000.00	25200	19,500.00	1060200
6	Digital Techniques	8 weelks	25	560000	195,000.00	16800	16,900.00	771800
7	Microprocessor & Microcomputer	12 weeks	25	840000	195,000.00	25200	19,500.00	1060200
8	Modern Communications & Microwave Techniques	12 weeks	25	840000	195,000.00	25200	19,500.00	1060200
9	ATC Console Maintenance	6 weeks	25	420000	195,000.00	12600	13,000.00	627600
10	Airport Weather Instrument	4 weeks	25	280000	195,000.00	8400	13,000.00	483400
11	VHF/HF Remote Control A/G (RCAG) Radio System	4 weeks	25	280000	195,000.00	8400	13,000.00	483400
12	Basic Airfield Power Technician Course	8 weeks	25	560000	195,000.00	16800	19,500.00	771800
13	Airport Maintenance Mechanical	12 weeks	25	840000	195,000.00	25200	19,500.00	1060200
14	Airport Maintenance Electrical	12 weeks	25	840000	195,000.00	25200	19,500.00	1060200
	T O T A L			9,984,800.00	2,535,000.00	289,800.00	270,400.00	12,809,600.00

ANNEX 4-2

ATO DPP

Expenditures	CY-1996 Actual	CY-1998 Proposal	Justification of P: (use separate sheets if n
03 Communications Services			
04 Repair & Maint. of Government Facilities :			
a. Operation, repair and maintenance of aircrafts			
b. Operation, repair and management of CATC(JICA EQUIPMENT)		₱ 1,955,066.96	
c. Repair and maintenance of airport vertical and horizontal facilities, including aircraft movement areas			
d. Repair and maintenance of air navigation facilities, buildings and installations			
1. A N S		₱ 73,965,053.15	
2. A T S			
05 Repair and maintenance of government vehicles			
06 Transportation services (Freight/Hauling)			
07 Supplies and materials (Annex "C")		6,030,676.50	Pls see attached
08 Provision for International and Domestic Leased Circuits		37,269,266.68	
11 Rental of lots			
14 Water, illumination and power			
15 Retirement gratuity (Annex B)			
17 Training and seminar expenses (Give training schedules)		12,900,000.00	Pls see attached

ANNEX 5-1

PROPOSED LIST OF TRAINING AIDS/EQUIPMENT

1. One (1) unit COPYING MACHINE (High speed/Heavy Duty)	• for reproduction of training manuals, including textbooks and laboratory handbooks
2. Four (4) sets PERSONAL COMPUTER with One (1) laser printer and One (1) COLOR INKJET PRINTER	• to be use by Counterpart in the preparation of the course materials and training manuals.
3. Two (2) Units OVER-HEAD PROJECTOR	• teaching aid
4. One (1) Unit LCD PROJECTOR (with appropriate connector/interface to PC)	• teaching aid
5. Four (4) Units ELECTRONIC POINTING DEVICE	• teaching aid
6. Sixteen (16) sets DIGITAL TRAINER	• training equipment
7. Sixteen (16) sets PERSONAL COMPUTER	• training equipment
8. One (1) 600x600 and One (1) 1200x750 DPI FLAT-BED SCANNER	• for reproduction of training manuals, including textbooks and laboratory handbooks
9. One (1) set of WINDOWS 95 and MICROSOFT OFFICE 95 SOFTWARES in CD Versions.	• for reproduction of training manuals, including textbooks and laboratory handbooks
10. One (1) unit ILS/VOR SIGNAL GENERATOR	• training equipment
11. Computer Aided Tools (Remote Control and Monitoring Terminal)	• training equipment
12. Analog & Digital Multi-tester (VOM)	• training equipment
13. Analog/ Digital Oscilloscope	• training equipment
14. Audio Signal Generator	• training equipment
15. Signal Level Meter	• training equipment

ANNEX 5-2

16. Selective Level Meter	• training equipment
17. RF Signal Generator	• training equipment
18. Pulse Generator	• training equipment
19. VSWR meter	• training equipment
20. Power Meter	• training equipment
21. Spectrum Analyzer	• training equipment
22. Wave meter	• training equipment
23. Frequency Counter (Audio/ Microwave)	• training equipment
24. Microwave test set	• training equipment
25. Basic electronic tools	• training equipment
26. SERVICE VEHICLE	

資料２．ATO とCATCへのQuestionnaire

Questionnaire

June 1997

Prepared by JICA supplementary study team for the project
"Upgrading Human Resource Development for ANSS
at the CATC Manila"

1. We formulated the Project Design Matrix (PDM) in the last Preliminary Study. Have you examined the PDM?

2. Needs of Training (Matters related to new curriculum)

2-1 What are ANSS's duties and their maintaining facilities?

2-2 It is very important to formulate a new curriculum for the ANSS, please answer to the following items.

a) Maintenance methods

What are the current maintenance methods? If you have maintenance regulations stipulated by ATO, please let us know the maintenance frequency, schedule, flight check, etc. for each equipment.

b) Maintenance tools

What kind of tools are used for the maintenance in the field? For example, oscilloscope, frequency counter, etc.

c) Maintenance organization

Please provide the current maintenance organization chart to maintain NAV/COMM systems.

d) Spare parts replenishment system

Spare parts replenishment is important for normal and sustainable maintenance management of NAV/COMM systems. Please provide information on current spare parts replenishment system.

2-3 Allocation of ANSS

Please provide the current situations of the ANSS allocation all over the nation. If you have a future allocation plan of the ANSS, please provide it.

2-4 Training of new graduates

What do you think of a necessary number of new graduates and duration of fundamental training every year? If you have any plan, please provide it.

2-5 Course curriculum and syllabi for new graduates training
Have you prepared course curriculum and syllabi for the training graduates newly employed? If so, please provide them.

2-6 Retraining of experienced ANSS
Have you prepared course curricula and syllabi for the retraining ANSS working in the field?

2-7 We understand that the needed training courses are composed of theory and practice in fundamental training (including A/G and NDB) and special training (VOR, DME, ILS and SSR). If you have any idea, please let us know.

3. Training system
3-1 Do you think the career development of ANSS is to change in the future? If so, please describe future career development in comparison with the present one.

3-2 For the purpose, how the training system of the ANSS should be reorganized in the future?

4. Training target and curriculum
4-1 What kind of skills do you expect the ANSS who will participate the training courses?

4-2 Which points should be mainly emphasized in each training course for the training targets?

4-3 Have you drafted the curriculum for each training course on Fundamental, OR, ME, LIS and SRS, respectively? If so, please let us know.

4-4 Have you drafted the syllabi for each curriculum? If so, please let us know.

5. Textbook and syllabus
What kind of textbooks, syllabi and training equipment (including provided ones) are needed for the training courses?

6. Annual plan of the training
6-1 Do you have annual plans for the new training courses? If so, please let us

know.

6-2 How many newly employed graduates should be trained annually?

6-3 How many ANSS should be retrained annually?

6-4 Do you anticipate any constraint on the retraining due to any reasons in the field?

7. Appointment of instructors

7-1 How many instructors will be required when the new training courses start?

7-2 Can you prepare a necessary number of instructors by the time courses start?

7-3 If you have any problem in recruiting from job site, which countermeasures should be taken to ensure the necessary number of the instructors?

8. Instructors' training

8-1 What do you think of necessity of the instructors' training in theory and practice?

8-2 If the instructors' training is required, in respect of the training, what are:

a) contents,
b) training methods,
c) duration,
d) places, and
e) trainers

9. Duty of Japanese expert

9-1 What do you think of the duties of the long term JICA experts?

9-2 We consider that the JICA experts aim to enhance and improve instructors' ability by efficient technology transfer to the instructors in the project, therefore they will not train trainees directly in principle. If you have any expectation to the Japanese experts, please describe it.

10 Measures taken by the Japanese side

10-1 In the JICA project, what kind of measures do you think to be taken by the Japanese side?

10-2 If you have any expectation to us, please let us know.

11. Master plan

11-1 Have you prepared annual plans for the JICA project? If so, please let us know.

11-2 How many long-term and short-term JICA experts and how long do you request for?

11-3 In which technical fields do you request for the experts?

11-4 How many your instructors, when, how long, and where do you request to train in Japan in the scheme of JICA counterpart training?

11-5 What are the training targets in the JICA counterpart training?

12. Do you have any request for the conditions of the project implementation, such as scope, date of commencement, duration, etc.?

13 Do you have any request or suggestions for the project in general?

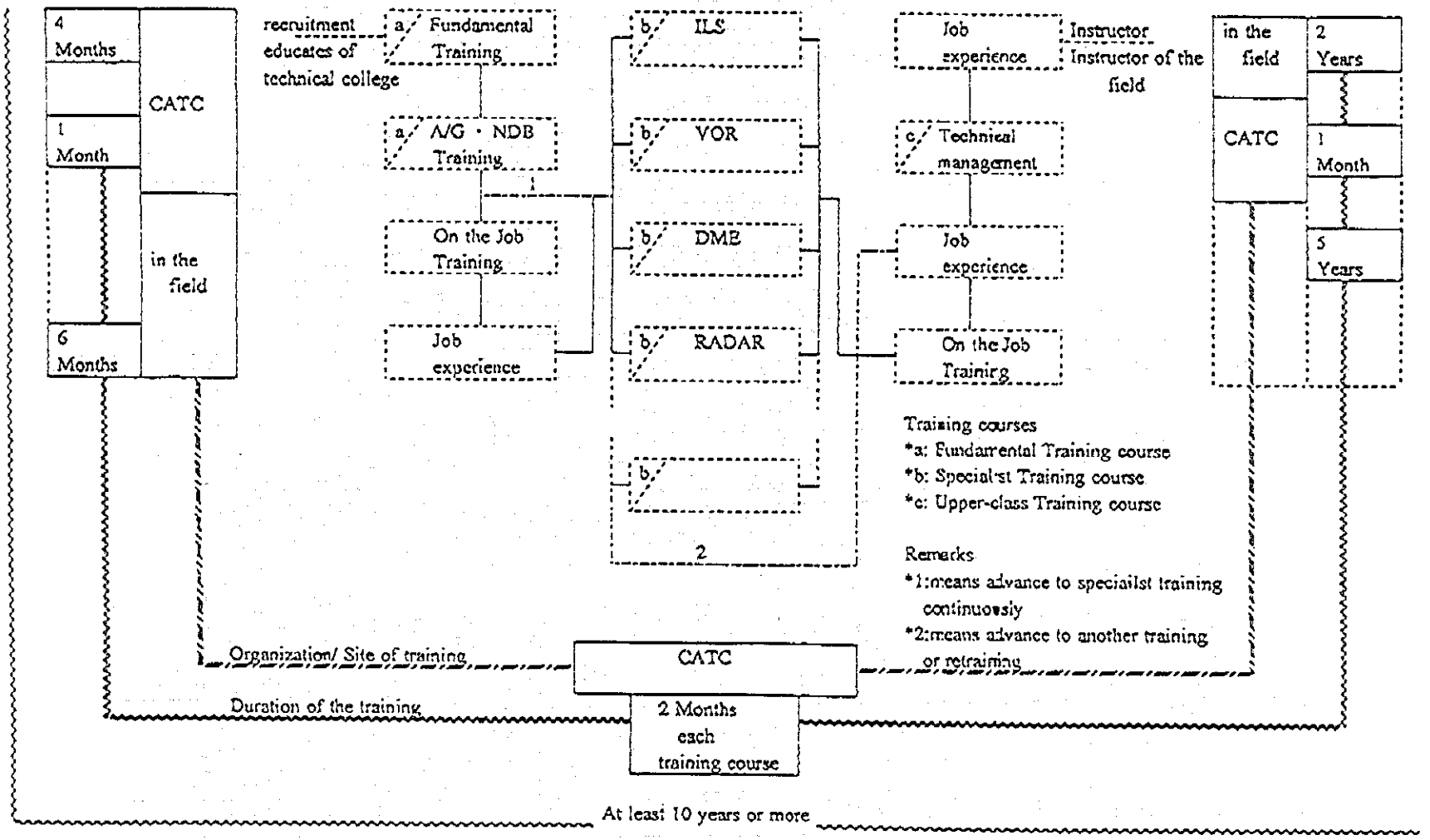
プロジェクトデザインマトリクス（第2稿）　　１９９７年７月２０日作成

プロジェクト名：マニラ航空保安大学校管制技術官育成計画　　プロジェクト期間：1997年10月1日ー2002年9月30日

プロジェクトの要約	指標	指標データ入手手段	外部条件
上位目標 比国での航空保安施設が適正に運用、維持、管理され、比国の航空の安全性が向上し、航空機が効率的に管制される	NAV/COM/Surveillanceの運用上の障害時間が明らかに減少する	1 運用障害報告書 2 NOTAM	航法援助装置の近代化 補修部品の供給確保 ANSSの適正配置
プロジェクトの目標 航空管制技術官の研修・訓練が改善され、質の高い航空管制技術官が育成される	400人のANSSを訓練	CATCの記録	ANSSがATCで継続して従事する
成果 1　系統的な航空管制技術研修・訓練コースのカリキュラムと教材が整備される 2　航空管制技術研修・訓練コースの指導教官が育成される 3　航空管制技術研修・訓練コースが運営される	1 1998年12月までに必要な教材が開発される 2 13名の教官が訓練される 3 訓練開始後毎年10コースが運営される	CATCの記録	インストラクターがCATCでフルタイムで従事する
活動 1-1　研修・訓練カリキュラム・教材委員会を設置する 1-2　系統的な研修・訓練コースの種類と内容を計画する 1-3　カリキュラム・教材担当者に事前研修を実施する 1-4　研修コース毎にカリキュラムを開発する 1-5　カリキュラム毎に教材を開発する 1-6　開発された教材を適切に管理する 2-1　必要な指導教官の能力の内容とレベルを確定する 2-2　教官養成プログラムを策定する 2-3　教官のための養成プログラムを実施する 2-4　教官用マニュアルを作成する 2-5　大学教官を対象に航空航法援助に関するセミナーを開催する 3-1　教官のチーム編成を確定する 3-2　研修・訓練コース開催スケジュールを確定する 3-3　受講生を募集する 3-4　研修・訓練コースを実施する 3-5　研修・訓練コースの結果を評価する 3-6　ＯＪＴプログラムが計画、実施、評価される 3-7　新技術（ＣＮＳ／ＡＴＭなど）の調査研究が行われる 3-8　最新の航空航法方式技術が関連する訓練コースで紹介される	投入 フィリピン側 1要員 プロジェクトマネージャー1名 事務員　2名 インストラクター　１３名 2運営、訓練経費、施設及び保障期間後の訓練機材の保守経費 3日本人専門家の執務スペース 4訓練設備 5訓練生の宿泊施設 日本側 1要員 長期専門家 チーフアドバイザー(エアートラフィック技術) 1名 調整員　1名 エアーナビゲーション技術　1名 レーダー技術　1名 必要に応じ短期専門家 2日本でのC／P訓練 3機材供与		訓練機材の税関及び国内輸送手続きが大幅に遅れない

Tentative Training system chart of ANSS for the project of
"Upgrading Human Resource Development for ANSS at the CATC in Manila"

June 1997



資料５．Questionnaire to ANSS

Questionnaire to ANSS

Date:
Name of Airport
Name of contact person
Position
Tel/Fax
NAV/COMM systems

1. Job analysis
 Job description of ANSS
 Breakdown of ANSS Jobs
 Anticipated job in the future

2. Job circumstances
 Organization
 Duty
 Responsibility
 Maintaining NAV/COMM system(s)
 Maintenance Manual
 Maintenance tools
 Spare parts
 Report system
 Work conditions
 Training Opportunities

Task List

Location

Job

Duty

Tasks

資料６．新規採用者の出身校

University/College	24th	25th	26th	27th	28th	Total
University of San Carlos *1	1	2	9	5	4	21
University of the East	5	3	2	2		12
Mapua Institute of Technology	3	1	2	2	1	9
St. Louis University *2		3	1	3	2	9
FEATI University	1	5	2			8
Bicol University			1	1	4	6
Central Philippine University			1	5		6
Polytechnique University of the Phils.		4	1	1		6
Adamson University	2		1	2		5
Cebu Institute of Technology		1	2		1	4
Central Colleges of the Philippines			2	2		4
Mindanao State University Iligan Inst. of Tech.	1			1	2	4
University of Southeastern Phils.				2	2	4
Western Mindanao State University			1		3	4
Technological University of the Phils.		1			2	3
University of San Jose Recoletos			1	1	1	3
University of Santo Thomas	1	2				3
Ateneo de Davao University				1	1	2
Cebu Technical School			1		1	2
De la Salle University	1	1				2
Eulogio Amang Rodriguez Inst. of Tech.		1	1			2
Manuel L. Quezon University		1		1		2
Mariano Marcos State University				1	1	2
Mindanao Polytechnique State University					2	2
Rizal Technological College		1	1			2
Technological Institute of the Philippines		1	1			2
University of the Visayas			2			2
Xavier university			1		1	2
Cebu Polytechnique School				1		1
Colleglo dela Puricima Conception		1				1
Divine Word University		1				1
Garcia Collegio of Technology			1			1
Iligan Institute of Technology			1			1
Matz College of Technology					1	1
New Era College			1			1
University of Mindanao			1			1
Total no. of Students	15	29	37	31	29	

※１；セブ島に所在

※２；バギオに所在

資料７．教育内容Questionnaire

Questionnaire

Date:
Name of the University:
Department:
Address:
Tel/Fax
Name(s) of contact person:

1. About students
   Entry requirement,
   Age,
   Selection methods at entrance,
   Number of applicants,
   Male/female ratio,
   Dropout rate,
   Current main problems

2. About your education
   Current curriculum
   Duration
   Subjects
   Ratio of Theory to practice/experiment
   Equipment for experiments
   Subjects of practice/experiments
   Language
   Teaching materials (especially, books in Practice/experiments)
   Current main constraints

3. Job opportunity
   Main job places of graduates
   The number of students who wish to work at Civil Aviation as an engineer or a specialist
   Grade of the students who were employed by Civil Aviation as an engineer

資料８．CATC入学試験問題

CATC 入学試験問題

Questionnaire No. _____
Place of Examination MANILA

Score ( )

I. Encircle the answer for the following.

1) In electronic circuits, a semi-conductor device
   A. are components like resistors and capacitors.
   B. controls the flow of current to produce pre-determined effect.
   C. can directly replace vacuum tubes.
   D. compensates for various deficiencies.

2) When a diode is used to convert alternating current into direct current, it is commonly referred to as
   A. alternator B. rectifier C. commutator D. regulator

3) If the series resistance required by a voltage regulator is calculated to be 215 ohms, it would be desirable to use standard resistance value of
   A. 150 ohms B. 180 ohms C. 220 ohms D 270 ohms

4) The collector-base junction of a transistor amplifier must always be
   A. subjected to high forward current. C. forward-biased.
   B. reverse-biased. D. subjected to low forward current.

5) A transistor that has an α of 0.97 will have a β of approximately
   A. 32 B. 320 C. 3.2 D. 64

6) An SCR will switch to the OFF state when its
   A. Gate current is reduced.
   B. Gate current is increased.
   C. Forward current is increased to sufficiently high value.
   D. Forward current drops below a level to sustain conduction.

7) A device that is commonly used to trigger the TRIAC is referred to as a
   A. Bipolar transistor B. Triggering thyristor C. SCR D. Diac

8) Which of the following formula can be used for determining the power factor of an AC circuit?
   A. PF = VA/W B. PF = (W)x(VA) C. PF = I^2Z D. PF = W/VA

9) Capacitance is a property of an electrical circuit that will
   A. aid any change in current C. oppose any change in current
   B. aid any change in voltage D. oppose any change in voltage

10) If the polarity markings of an electrolytic capacitor are not observed, the result can be wrong polarity connection and the capacitor will then function as
   A. Resistor B. Inductor C. Short circuit D. Open circuit

11) A series circuit consist of 50 ohms resistance in series with 50 ohms of inductive reactance. The impedance of the circuit is
   A. 100 ohms B. 71 ohms C. 50 ohms D. 25 ohms

12) In parallel R.L. and C circuit, the current of each branch is
   A. the same. B. added. C. added vectorially. D. subtracted.

13) The average value of actual power is called
   A. apparent power B. reactive power C. factored power D. true power

14) A practical and economical power factor correction device is the
   A. inductor B. capacitor C. resistor D. motor

16) The most heavily doped portion of a bipolar transistor is the
A. base B. collector C. emitter D. junction

17) The major difference between PNP and NPN transistors is that
A. current flows through the transistor in the opposite direction.
B. the base of a PNP transistor is heavily doped.
C. base current in an NPN transistor is large.
D. a PNP transistor has fewer junctions.

18) Electron flow in an N-channel JFET is from the Source, through the N-channel to the
A. Gate B. Grid C. Anode D. Drain

19) In a Darlington pair configuraton
A. the value of β very high.
B. the collectors of the two transistors are connected together.
C. emitter current from one transistor is the input to the base of the second transistor.
D. all of the above.

20) An IC made by silk screening components into a substrate is a
A. monolithic IC B.thick-film IC C.thin-film IC D.hybrid IC

21) An Op-Amp is a type of
A. digital IC B. voltage regulator C. logic gate D. linear IC

22) Which type of meter is less susceptible to extraneous noise?
A. Digital multimeter C. VOM meter
B. Analog multimeter D. None of the above

23) An AC voltmeter reading of 20V will indicate peak to peak voltage of _____ in the oscilloscope?
A. 20 V B. 56 V C. 45 V D. none of the above

24) For best performance, the maximum operating frequency of a transistor should be what percentage of the cut-off frequency of the transistor?
A. 50% B. 100% C. 20% D. 80%

25) Determine the total current in a circuit consisting of four resistors of 4,6,8,10 Ω connected in parallel across a 10 volt source.
A. 0.359 A B. 28 A C. 6.42 A D. 0.155 A

26) A battery has an EMF of 1.2 volts and an internal resistance of 0.8Ω. Determine the maximum power delivered.
A. 1.8 w B. 2.4 W C. 0.45 W D. 0.225 W

27) How much power is delivered if a 25.5 volts peak to peak undistorted sine wave measured across an 8-Ω load?
A. 16 W B. 78 W C. 10 W D. 204 W

28) The fourth band of a 1 KΩ resistor is gold. The actual resistance may be anywhere between
A. 900 to 1100Ω B. 950 to 1050Ω C. 800 to 2000Ω D. 990 to 1010Ω

29) Which of the following resistors dissipate the most heat.
A. 125Ω resistor with 5 volts voltage drop.
B. resistor with 25V voltage drop and a current of 0.5A.
C. 12Ω resistor with 2A current.
D. 12KΩ resistor with 25 mA current.

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30) The sensitivity of a moving coil meter movement is 1000Ω/volt. The full scale deflection current is
A. 10 μA B. 1.0 mA C. 0.1 mA D. 10 mA

31) Find the cut-off frequency for a simple low pass RC filter if R=1K and C=0.01 μF.
A. 1.0 Khz B. 1.5 Khz C. 10.2 Khz D. 15.5 Khz

32) What is the bandwidth of a narrowband FM signal which is generated by a 5Khz audio signal modulating a 115 MHZ carrier?
A. 5 Khz B. 10 Khz C. 13 Khz D. 30 Khz

33) The RF spectrum of UHF (Ultra High Frequency) is
A. 300-3000 Khz B. 30-300 Mhz C. 300-3000 Mhz D. 3-30 Mhz

34) An electron tube in which the electron are periodically bunched by electric fields and is used as an oscillator or amplifier in microwave transmitters and receivers.
A. Crystal oscillator B. Klystron C. Power Amplifier D.Electron Gun

35) It is used for mixing the output of 2 transmitters that use the same antenna system.
A. Diplexer bridge C. Multiplexer
B. Matching transformer D. Dummy couple

36) Which type of feedback will increase the BW of an amplifier?
A. Negative/Degenerative feedback C. Open loop
B. Positive/Regenerative feedback D. None of the above

37) Increasing the bandwidth of an amplifier will ____ its noise.
A. decrease B, increase C. no effect D. none of the above

38) _____ has an output frequency that is dependent on the DC voltage input.
A. Amplifier C. Phase locked loop
B. Voltage-controlled oscillator D. Comparator

39) _____ provides a DC output voltage that is related to the difference in phase between two input signals.
A. Oscillator B. Amplifier C. Phase comparator D. None of the above

40) _____ are transmission circuits used to interconnect two switching centers.
A. Subscriber B. Trunk circuits C. Current loop D. All of the above

41) _____ is the inverse of the period of the shortest information unit used in code transmission.
A. Binary digit B. Baud C. Frequency D. None of the above

42) An amplifier has an input of 0.05 volts. If its output is 6.375 volts, determine the amplifier gain in db.
A 45.42 db B. 42.11 db C. 40.02 db D. 41.25 db

43) What type of modulation is used in digital transmission?
A Pulse width modulation C. Amplitude modulation
B. Pulse code modulation D. Pulse frequency modulation

44) A 500-W carrier is modulated to a depth of 70 percent. Calculate the total power in the modulated wave.
A. 640 W B. 600 W C. 612.5 W D. 622.5 W

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45) The field strength of a transmitted signal depends on
A. effective height of antenna C. distance from antenna
B. frequency or wavelength used D. all of the above

46) It is a system of conductors and insulators used to conduct electromagnetic waves. Conduction of energy takes place not through its walls but through the dielectric filling of the system.
A. Coaxial cable B. Waveguides C. Couplers D. Duplexer

47) It is a theoretical antenna with a radiation pattern that is perfectly omnidirectional or spherical.
A. Dipole antenna C. Helical antenna
B. Isotropic antenna D. Marconi antenna

48) The modulation index of an AM wave is changed from 0 to 1. The transmitted power is _____.
A. unchanged B. halved C. doubled D. increased by 50%

49) Vestigial sideband modulation is normally used for
A. HF point to point communications.
B. Radio broadcasting.
C. TV broadcasting.
D. Stereo broadcasting.

50) A superheterodyne receiver with an IF of 450 Khz is tuned to 1200 Khz. The image frequency is
A. 750 Khz B. 900 Khz C. 1650 Khz D. 2100 Khz

51) Indicate the false statement. The SWR on a transmission line is infinity: the line is terminated in
A. a short circuits. C. an open circuit.
B. a complex impedance. D. a pure reactance.

52) Frequencies in the UHF range normally propagate by means of
A. ground waves B. sky waves C. surface waves D. spacewaves

53) Which of the following does not apply to Yagi-Uda array?
A. Good bandwith C. Folded dipole
B. Parasitic elements D. High gain

54) Indicate which of the following diodes does not use negative resistance in its operation.
A. Backward B. Gunn C. Impatt D. Tunnel

55) The biggest disadvantage of PCM is
A. its inability to handle analog signals.
B. the high error rate which its quantizing noise introduces.
C. its incompatibility with TDM.
D. the large BW that are required for it.

56) The most commonly used logic format is
A. sum-of-products C. combination of A and B
B. product-of-sum D. either A and B

57) The ambiguous state in a flip-flop is indicated by which of the following conditions?
A. Both outputs are low C. Either A and B
B. Both outputs are high D. One output is low, the other is high

58) What type of IC family is used with negative 5 volts power supply?
A. CMOS B. TTL C. ECL D. Transistors

29) ___ is a program that manages all the system resources of a computer.
A. Applications C. Operating System
B. Assembly Language D. None of the above

30) _____ is a solution procedure for a programming problem.
A. Coding B. Simulation C. Algorithm D. None of the above

31) _____ is a two-dimensional representation to indicate operations and flow control in a programming solution.
A. Coding B. Outline C. Flowchart D. None of the above

32) What is the equivalent of $8B_{16}$ in decimal?
A. 250 B. 139 C. 275 D. 312

33) The most important characteristic of _____ codes is that when the count is incremented by one, only one bit will change state.
A. Gray B. 8421 C. xs3 D. 4221

34) The telephone was invented by
A. Watson B. Bell C. Strowger D. Edison

35) Time division multiplexing is used for _____ transmission.
A. analog B. digital C. both A&B D. none of the above

36) The purpose of a microcomputer in the telephone network is
A. to provide calculation function through the keypad.
B. to replace wired logic and control with programmed functions.
C. to offer games as an extra cost option.
D. because an electric telephone is not possible without one.

37) Telephone network is being converted to digital operation primarily to
A. carry digital computer data C. improve speech quality
B. reduce cost D. increase system capacity

38) Transmission medium in optical communication is
A. fiber optic C. coaxial cable
B. twisted pair telephone line D. space or the air

39) The program counter of a microcomputer contains
A. address of data C. address of an instruction
B. value of the data D. none of the above

40) Any digital system can be completely fabricated using
A. all NOR gates C. both A & B above
B. all NAND gates D. AND and OR gates only

41) The process of photomasking is
A. a photographic process.
B. used to selectively remove areas of unwanted materials such as oxide.
C. used to define areas that will be diffused into.
D. all of the above

42) A register is used to
A. store a group of related binary bits
B. provide random access data
C. store a single bit of binary information
D. none of the above

43) The basic application of the D flip-flop is
A. Switch contact debouncing C. Frequency division
B. Registers D. Counting

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Ans: C

'4) Which of the following best describe D'Arsonval meter movement
A. current carrying coil which rotates in the field of permanent magnet
B. current through the coil causes a permanent magnet to rotate
C. current flow through a coil creates a magnetic field which causes rotation of another coil.
D. two permanent magnets are attached to each other

'5) A rectifier type of AC meter will respond to the
A. Average value of current C. Peak value of current
B. RMS value of current D. Peak to peak value of current

'6) What is the function of the A/D converter ?
A. Convert AC voltage to DC voltage.
B. Convert analog information to digital information.
C. Convert input parameter into decimal equivalent for meter use.
D. Convert series of digital places into an accurate display.

'7) An instrument that display signal strength against frequency is the
A. oscilloscope C. EVOM
B. RF voltmeter D. Spectrum Analyzer

'8) Device used to change the input state of digital circuits is called
A. logic probe C. data domain signal injector
B. logic pulser D. digital logic pulse stretcher

'9) Error produced by placing a meter in a circuit for measurements is
A. factor error C. reading error
B. loading error D. calibration error

30) The value of forward voltage where forward current increases significantly for diodes is
A. breakdown voltage C. knee voltage
B. clipping voltage D. reverse voltage

31) Using an attenuator in cascade with a source or load in order to match the characteristic impedance of the circuit is
A. compensation B. padding C. matching D. all of the above

32) The rate at which a filter attenuation is increased in a stop-band filter
A. cut-off B. octave C. roll-off D. asymptote

33) A condition in the transistor whereby the collector current produces enough voltage drop in the external circuitry to reduce the collector-emitter voltage essentially to zero.
A. bias B. cut-off C. saturation D. none of the above

34) An amplifier with two inputs with the output as an amplified algebraic difference of the inputs.
A. phase B. cascade C. differential D. matched

35) A display of harmonic amplitudes versus the harmonic number or frequency
A. periodic window B. sinusoid C. spectrum D. distortion

36) Which of the following amplifier (FET) configuration has a low input impedance and a high output impedance?
A.common gate B.common drain C.common source D.common emitter

37) Noise signals that covers the audio and the RF frequency ranges
A. random B. coupling C. white D. pink

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88) In the FM band, if a receiver is tuned to 101.1 Mhz , the local oscillator frequency is
A. 121.1 Mhz B. 111.8 Mhz C. 91.1 Mhz D. none of the above

89) Component used to get a reference voltage in a regulated power supply
A. Capacitor B. Resistor C. Zener Diode D. Transistor

90) A resistor has three red bands its value is
A. 222 ohms B. 220 ohms C. 2200 ohms D. 0.22 ohms

91) Current is defined as the flow of
A. protons from a negative source to a positive source
B. protons from a positive source to a positive charge
C. electrons from a negative source to a positive charge
D. electrons from a positive source to a negative charge

92) Ohms's law states that current is
A. inversely proportional to voltage and directly proportional to resistance
B. inversely proportional to both voltage and resistance
C. directly proportional to both voltage and resistance
D. inversely proportional to resistance and directly proportional to voltage

93) In using an ohmmeter to measure an in-circuit resistor,
A. The polarity of the resistor must be observed.
B. The resistor must remain in the circuit.
C. The resistor must be disconnected from the circuit.
D. The measured resistance will be higher from the actual value.

94) Using the left hand rule for conductors, the thumb points
A. toward the north pole of the conductor.
B. in the direction of the magnetic field.
C. in the direction of current flow.
D. in the direction the conductor will move.

95) Accuracy of a meter is specified as a percentage of error at
A. full-scale deflection B. mid-scale deflection C. 50 μAmp.
D. 1.0 volt

96) In a voltage divider the only current in the circuit that does not flow through one of the loads is usually referred to as
A. nonload current B. parallel current C. bypass current
D. bleeder current

97) Alternating current changes in
A. direction only C. both value and direction
B. value only D. frequency and value but not direction

98) A current sine wave with a peak value of 16 Amps. would have an effective value of
A. 10.18 Amps. B. 11.3 Amps. C. 200.63 Amps. D. 25.16 Amps.

99) The ignition system of a car is set up so that the engine cannot be started unless the driver's front door is closed, the front seat belts are latched, and the ignition key is ON. What logic function is applied?
A. AND B. OR C. NAND D. NOR E. NOT

100) How many flip-flops will be needed to store the binary equivalent of the decimal number 114 ?

資料9．CATC基礎コースカリキュラム

SUBJECTS, DURATION AND NUMBER OF SESSIONS
ON THE PROPOSED AIR NAVIGATION SYSTEM SPECIALIST COURSE
(ANSS COURSE)

	SUBJECT	CODE	SESSION	DURATION
1.	TRAINING ORIENTATION	TO	2	6 HRS.
2.	LABORATORY ORIENTATION	LO	2	6 HRS.
3.	DIRECT CURRENT CIRCUITS	DC	9	27 HRS.
4.	ELECTRON & SEMICONDUCTOR DEVICES	ESD	12	36 HRS.
5.	ALTERNATING CURRENT CIRCUITS	AC	10	30 HRS.
6.	POWER SUPPLY CIRCUITS	PS	10	30 HRS.
7.	AMPLIFIER CIRCUITS	AMP	25	75 HRS.
8.	DIGITAL TECHNIQUES	DT	25	75 HRS.
9.	OSCILLATOR CIRCUITS	OSC	15	45 HRS.
10.	PULSE CIRCUITS	PC	15	45 HRS.
11.	TRANSMISSION LINES	TXL	7	21 HRS.
12.	ANTENNA SYSTEM	ANT	8	24 HRS.
13.	MODULATION & WAVE PROPAGATION	MWP	5	15 HRS.
14.	COMMUNICATION SYSTEM	COM	20	60 HRS.
15.	NAV. AIDS SYSTEM	NAV	20	60 HRS.
16.	RADAR SYSTEM	RDR	20	60 HRS.
17.	COMPUTER SYSTEM	CMP	20	60 HRS.
18.	FUTURE AIR NAVIGATION SYSTEMS	FANS	5	15 HRS.
19.	POWER PLANT	PP	4	12 HRS.
20.	AIR TRAFFIC SERVICE	ATS	1	3 HRS.
21.	AIR NAVIGATION SYSTEM/SERVICE	ANS	1	3 HRS.
22.	TRAINING EVALUATION	TEV	2	6 HRS.
23.	GRADUATION DAY	GD	2	6 HRS.
			240	720 HRS.

資料10. フィリピン国の工科系大学のカリキュラム

(1) サンカルロス大学カリキュラム

UNIVERSITY OF SAN CARLOS
Cebu City, Philippines

BS in ELECTRONICS & COMMUNICATIONS ENGINEERING
(For students expecting to graduate on 1997, and 98)

FIRST YEAR

FIRST SEMESTER					SECOND SEMESTER				
COURSE		LEC	LAB	UNITS	COURSE		LEC	LAB	UNITS
ES 11	Intro to Eng'g Anal	5	0	5	ES 13	Eng'g Analysis 1	5	0	5
ES 12	Eng'g Graphics 1	0	6	2	ES 14	Eng'g Graphics 2	1	3	2
Chem 4	Gen/Inorg Chem 1	3	3	4	Chem 14	Gen/Inorg Elem Qual Analysis	3	3	4
Engl 1	Grammar/Comp 1	3	0	3	Engl 2	Grammar/Comp 2	3	0	3
Pili 91	Sining ng Pakikipagtalastasan	3	0	3	Pili 92	Panitikang Pilipino	3	0	3
Reed 10	Man in Search of God	3	0	(3)	Reed 20	Man the Christian Bel	3	0	(3)
PE 11	Basic Course 1			2	PE 12	Basic Course 2			2
CMT 11	Military Science 1			1.5	CMT 12	Military Science 2			1.5
		17	9	20.5			18	6	20.5

SECOND YEAR

ES 15	Eng'g Analysis 2	5	0	5	ES 15A	Eng'g Analysis 3	3	0	3
Phys 31	Eng'g Physics 1	3	3	4	ES 16A	Computer Fund & Prog.	2	1	3
Engl 23	Technical Writing	3	0	3	ES 17	Differential Eqns.	3	0	3
Posc 13	Current Issues	3	0	3	ES 18	Eng'g Mechanics	5	0	5
Phil 2	Logic	3	0	3	Phys 32	Eng'g Physics 2	3	3	4
PE 13	Basic Course 3			2	PE 14	Basic Course 4			2
CMT 21	Military Science 3			1.5	CMT 22	Military Science 4			1.5
ECE Tech 11	Comm. Tech.	1	3	2					
		18	6	23.5			16	4	21.5

THIRD YEAR

ES 19	Advanced Eng'g Math	3	0	3	ES 23	Numerical Methods	3	0	3
ES 20	Strength of Mat'ls	3	0	3	EE 12	Eng'g Materials	3	0	3
ES 21	Thermodynamics	3	0	3	EE 14	Circuits 2	3	0	3
ES 22	Electrical Circuits	3	0	3	EE 15	Circuits 2 Lab	0	3	1
EE 11	Elect'l Circuits Lab	0	3	1	ECE 11	Electronics 1	3	0	3
EE 13	Electromagnetics	3	0	3	ECE 12	Electronics 1 Lab	0	3	1
Phys 33	Modern Physics	3	0	3	Reed 40	The Christian Witness to the World	3	0	(3)
Reed 30	The Christian in Worship	3	0	(3)	Psyc 1	General Psychology	3	0	3
Econ 1	Intro to Econ Facts and Principles	3	0	3	Sosc 6	Phil Society & Cult	3	0	3
		24	3	22			21	6	20

FOURTH YEAR

ES 24	Prob and Statistics	3	0	3	EE 21	Control System	3	0	3
ES 25	Eng'g Economics	3	0	3	ECE 15	Principles of Com	3	0	3
ES 27	Eng'g Management	3	0	3	ECE 16	Electronics 3	3	0	3
EE 16	Energy Conversion	3	0	3	ECE 17	Electronics 3 lab	0	3	1
EE 17	Energy Conver. lab	0	3	1	ECE 22	Industrial Electronic	3	0	3
ECE 10	ECE Laws,Contr & Eth	3	0	3	ECE 22L	Industrial Electn Lab	0	3	1
ECE 13	Electronics 2	3	0	3	ComE 30	Logic Ckt & SW Theory	3	0	3
ECE 14	Electronics 2 Lab	0	3	1	ComE 31	Logic Circuit Lab	0	3	1
ES 29L	Appl. Softwares Lab	0	3	1	Spch 4	Oral/Aural Comm	0	6	3
		18	9	21			15	15	21

FIFTH YEAR

ES 26	Elements of Research	2	0	2	ECE 23	Design Project	1	6	3
ECE 18	Wireless Comm	3	0	3	ECE 24	Broadcast Eng'g & App. Acoustics	3	0	3
ECE 19	Wire Communication	3	0	3	ECE 25	Broad Eng/Acoust lab	0	3	1
ECE 20	Comm Sys Anal & Dsgn	3	0	3	ECE 26	Data Communications	3	0	3
ECE 21	Comm Circuits Lab	0	3	1	ECE 27	Nav. Aids & Dev.	3	0	3
ECE EL	Technical Elective	3	0	3	ECE 28	Seminars/Field Trips	0	3	1
ComE 26	Intro to Micpr. Sys.	3	0	3	ECE EL	Technical Elective	3	0	3
ComE 26L	Intro to Micpr lab	0	3	1	ECE 31	Electronic Instmntion	3	0	3
ECE 30	Microelectronics	3	0	3	Hist 17	Rizal Course	3	0	3
		20	6	22			19	12	23

ELECTRONICS AND COMMUNICATIONS ENGINEERING
GENARO VILLANUEVA – HEAD

The Electronics and Communications Engineering Curriculum offered in Feati University is in line with the requirements of government and industry. The primary objectives are to produce graduates who are highly trainable; electronics and communications engineers who can easily re-orient themselves to the rapid changing technology.

The curriculum in the first two years is common with the other engineering disciplines. The primary concern is to develop proficiency in basic sciences, mathematics and technical English, preparatory to instructions in basic engineering sciences.

Basic engineering subjects, together with elements in parallel engineering disciplines are taken up during the third and fourth years. With these strong foundations, the graduates are expected to easily fit in the man-power demands of business and industry.

Courses in the fifth year are predominantly professional in nature. Included are analysis and design of electronics, communications and computer systems, as well as navigational aids and industrial electronics and control systems.

This academic training is expected to give the future electronics and communications engineer a high degree of self-confidence that is vital to a successful professional engineering practice.

The electronics and communications engineering laboratory has the facility to enable students to perform experiments in communications, electronics and digital logic. The computer center is equipped with Apple and IBM computers, which are used not only by ECE students, but also by students of the other engineering disciplines, as well as students taking the BSBA and Secretarial courses.

A Five Year Course Leading to the Degree of BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING (B.S.E.C.E.)

EFFECTIVE 1993 - 1994

CURRICULUM GUIDE

First Year - First Semester

COURSE	NO	SUBJECTS	No. of Hours Lec.	Lab.	Units	Pre-requisites *Co-requisites
Math	114	Elementary College Algebra	3	0	3	
Math	116	Plane Trigonometry	3	0	3	*Math 114
Chem	111	General Chemistry 1	3	3	4	
Draw	111	Engineering Drawing 1	0	6	2	
Fil	111	Sining ng Pakikipagtalastasan	3	0	3	
Engl	111	Basic Communication Skills 1	3	0	3	
Hum	111	Logic	3	0	3	
Rel	111	Christian Doctrine 1	(1)	0	(1)	
PE	111	Physical Education 1	2	0	2	
AROTC	11	Air Science and Tactics	0	4.5	1.5	
			20	13.5	24.5	

First Year - Second Semester

Math	125	Analytic Geometry (with Solid Geometry)	3	0	3	Math 114,116 *Math 121
Math	121	Advanced College Algebra	3	0	3	Math 114
Chem	121	General Chemistry 11	3	3	4	Chem 111
Draw	121	Engineering Drawing 11	0	6	2	Draw 111
Fil	121	Panitikang Filipino	3	0	3	Fil 111
Engl	121	Basic Communication Skills 11	3	0	3	Engl 111
Rizal	111	Buhay at Panitik	3	0	3	
PE	121	Physical Education 11	2	0	2	PE 111
Rel	121	Christian Doctrine 11	(1)	0	(1)	Rel 111
AROTC	12	Air Science & Tactics	0	4.5	1.5	
			20	13.5	24.5	

Second Year - First Semester

Engl	210	Advanced Communication Skills 1	3	0	3	Engl 121
Math	211	Differential Calculus	5	0	5	Math 125
Phys	211	Engineering Physics 1	3	6	5	Math 114,116
Engl	222	Public Speaking	3	0	3	Engl 121
Socio	111	Fundamentals of Sociology with Family Planning	3	0	3	
Econ	100	Principles of Economics with Taxation and Land Reform	3	0	3	
PE	211	Physical Education 111	2	0	2	PE 121
AROTC	21	Air Science & Tactics	0	4.5	1.5	
			22	10.5	25.5	

(2) FEATI 大学カリキュラム

COURSE NO		SUBJECTS	No. of Hours Lec.	Lab.	Units	Pre-requisite *Co-requisite
		Second Year - Second Semester				
Engl	220	Advanced Communication Skills II	3	0	3	Engl 210
Math	221	Integral Calculus	5	0	5	Math 211
Phys	221	Engineering Physics II	3	6	5	Phys 211
Engl	221	Technical Report Writing	3	0	3	Engl 121
PolSc	121	Philippine Government, The New Constitution & Current Issues	3	0	3	
Psy	111	General Psychology	3	0	3	
PE	221	Physical Education IV	2	0	2	PE 211
AROTC	22	Air Science & Tactics	0	4.5	1.5	
			22	10.5	25.5	
		Third Year - First Semester				
Math	323	Differential Equation	3	0	3	Math 221
Comp	31	Computer Fundamentals and Programming	2	3	3	
ECE	31	Electronics I	3	3	4	Phys 221, *EE
EE	31	Circuits I	3	3	4	Phys 221 & Math 221
ECE	32	Electromagnetics	3	0	3	*EE 31
ECE	33	Engineering Materials, Construction & Processes	3	0	3	*ECE 31
			17	9	20	
		Third Year - Second Semester				
EE	35	Circuits II	3	3	4	EE 31
ECE	35	Electronics II	3	3	4	ECE 31
Mech	315	Engineering Mechanics	5	0	5	Phys 211 & Math 221
ME	33	Thermodynamics	4	0	4	Phys 221 & Math 221
Math	411	Advanced Engineering Math	3	0	3	Math 323
			18	6	20	
		Fourth Year - First Semester				
Math	418	Statistics and Probability	3	0	3	Math 114
Mech	325	Strength of Materials	5	0	5	Mech 315
EM	500	Engineering Economics	3	0	3	
ECE	41	Electronics III	3	3	4	ECE 35
ECE	42	Principles of Communications	3	0	3	ECE 35
ECE	43	Communication Circuits Lab	0	3	1	*ECE 42
			17	6	19	
		Fourth Year - Second Semester				
ManE	400	Engineering Management	3	0	3	
EE	40	Energy Conversion	3	3	4	EE 35
ECE	45	Communication Systems, Analysis and Design	3	0	3	ECE 42
ECE	46	Control Systems	3	0	3	ECE 41
Comp	45	Logic Circuits and Switching Theory	3	0	3	Comp 31 & EC
GE	210	Plane Surveying	1	3	2	Math 116
Hist	111	Philippine History	3	0	3	
			19	6	21	

FEATI UNIVERSITY 1993 - 1994

COURSE NO		SUBJECTS	No. of Hours Lec.	Lab.	Units	Pre-requisites *Co-requisites
		Fifth Year - First Semester				
ECE	51	Wireless Communications	3	0	3	ECE 42
ECE	52	Wire Communications	3	0	3	ECE 42
ECE	53	Industrial Electronics	2	3	3	ECE 46
Elective		Technical Elective I	3	0	3	
Comp	51	Advanced Basic Programming	2	3	3	Comp 31
Comp	52	Microprocessor Systems	3	3	4	Comp 45
			16	9	19	
		Fifth Year - Second Semester				
ECE	55	Data Communications	3	0	3	ECE 45
ECE	56	Broadcast Engineering and Acoustics	3	3	4	ECE 45
Elective		Technical Elective II	3	0	3	
ECE	57	ECE Laws, Ethics & Contracts	3	0	3	ECE 45
ECE	58	Seminars & Trips	0	3	1	ECE 45
ECE	60	Microwave Systems Design	3	0	3	ECE 51
ECE	59	Sp. ECE Problems	3	0	3	Graduating
			18	6	20	
		SUBJECTS IN LIEU OF SPANISH:				
Math	121	Advanced College Algebra	3	0	3	Math 114
Comp.	51	Advanced Basic Programming	3	0	3	Comp 31
ECE	60	Microwave Systems Design	3	0	3	ECE 51
ECE	59	Sp. ECE Problems	3	0	3	Graduating
		SUGGESTED TECHNICAL ELECTIVE COURSES:				
ECE	50	Electronics Aids to Navigation	3	0	3	ECE 42
Comp	54	Computer Systems Design	3	0	3	*Comp 52
CAD	111	Computer Aided Design I	2	3	3	Comp 31
CAD	222	Computer Aided Desgin II	2	3	3	CAD 111

(3) Mapua Institute Technologyカリキュラム

BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

(Applicable to students who entered as new freshmen beginning the school year 1993-94)

FIRST YEAR and SECOND YEAR: Refer to Basic Courses

	New Code		Subjects	HRS lec	HRS lab	UNITS Credit	Prerequisite(s)	TAKE W/ (Simultaneously)
3rd Year 1st sem.	EEDE	311L	Network Analysis I (lab)	0	3	1	-	EEDE 313
	EEDE	313	Network Analysis I	3	0	3	PHDB 223/221L, MADB 225	EEDE 311L
	ELDE	311L	Basic Electronics (lab)	0	3	1	-	ELDE 313
	ELDE	313	Basic Electronics	3	0	3	PHDB 223/221L	ELDE 311L
	KODE	353	Fundamentals of Computer Science	3	0	3	MADB 225	-
	MADX	313	Differential Equations	3	0	3	MADB 225	-
	MKDE	313	Engineering Mechanics	3	0	3	MADB 225, PHCB 223	-
	SHDE	311L	Electrical Shop Practice	0	3	1	-	-
	ENZX	002	Readings on Science and Technology	2	0	2	ENDB 223	-
			TOTAL	17	9	20		
3rd year 2nd sem.	EEDE	321L	Network Analysis II (lab)	0	3	1	EEDE 313/311L	EEDE 323
	EEDE	323	Network Analysis II	3	0	3	EEDE 313/311L	EEDE 321L
	EEDE	343	Mathematical Methods in Network Analysis	3	0	3	MADX 313	-
	ELDE	321L	Electronics Engineering (lab)	0	3	1	ELDE 313/311L	ELDE 323
	ELDE	323	Electronics Engineering	3	0	3	ELDE 313/311L	ELDE 321L
	KODE	321L	Computer Programming (lab)	0	3	1	-	KODE 322
	KODE	322	Computer Programming	2	0	2	KODE 353	KODE 321L
	MEDE	383	Thermodynamics	3	0	3	MADB 225, PHDB 223	-
	MKDE	323	Strength of Materials	3	0	3	MKDE 315	-
	PSZX	002	Public Speaking on Technical Matters	2	0	2	ENZX 002	-
			TOTAL	19	9	22		

	New Code		Subjects	HRS lec	HRS lab	UNITS Credit	Prerequisite(s)	TAKE W/ (Simultaneously)
4th year 1st sem.	EEDE	413	Network Analysis III	3	0	3	EEDE 323	-
	EEDE	431L	Electric Machinery I (lab)	0	3	1	EEDE 323/321L	EEDE 433
	EEDE	433	Electric Machinery I	3	0	3	EEDE 323/321L	EEDE 431L
	EEDE	453	Numerical Methods	3	0	3	EEDE 343	-
	ELDE	413	Electromagnetics	3	0	3	EEDE 343, ELDE 325	-
	ELDE	471L	Industrial Electronics (lab)	0	3	1	ELDE 323/321L	ELDE 473
	ELDE	473	Industrial Electronics	3	1	3	ELDE 323/321L	ELDE 471L
	KODE	433	Logic Circuits and Switching Theory	3	0	3	KODE 322/321L	-
	KODE	431L	Logic Circuits and Switching Theory (lab)	0	3	1	KODE 322/321L	-
			TOTAL	18	9	21		
4th year 2nd sem.	EEDE	441L	Electric Machinery II (lab)	0	3	1	EEDE 433/431L	EEDE 443
	EEDE	443	Electric Machinery II	3	0	3	EEDE 433/431L	EEDE 441L
	EEDE	463	Engineering Probability and Statistics	3	0	3	4th year standing	-
	EEDE	482	Engineering Materials and Processes	2	0	2	CMDB 222, PHDB 223	-
	EEDE	483	Engineering Economics and Accounting	3	0	3	4th year standing	-
	ELDE	481L	Principles of Communications System (lab)	0	3	1	ELDE 473/471L	ELDE 483
	ELDE	483	Principles of Communications System	3	0	3	ELDE 473/471L	ELDE 481L
	ELDT	461D	Electronics Design (dsgn)	0	3	1	ELDE 473/471L	-
	KODE	423	Microprocessors	3	0	3	KODE 433/431L	-
	KODE	421L	Microprocessors (lab)	0	3	1	KODE 433/431L	-
			TOTAL	17	12	21		

	New Code		Subjects	HRS lec	HRS lab	UNITS Credit	Prerequisite(s)	TAKE W/ (Simultaneously)
5th year 1st sem.	EEDE	512	Elements of Research and Project Study	2	0	2	EEDE 483	-
	EEDE	553	Control Systems	3	0	3	EEDE 443	-
	EEDE	571	Machinery Foundation	1	0	1	MKDE 323	-
	ELDT	511D	Communications Systems Analysis (dsgn)	0	3	1	ELDE 483	-
	ELDT	513	Communications Systems Analysis	3	0	3	ELDE 483/451L	-
	ELDT	532	Electronic Navigational Aids & Devices	2	0	2	ELDE 483	-
	ELDT	553	Transmission Lines, Antenna and Radiowave Propagation	3	0	3	ELDE 483	-
	ELDT	573	Advanced Electronics Engineering	3	0	3	ELDT 452D	-
	KODT	571D	Computer Systems Design (dsgn)	0	3	1	KODE 423	KODT 572
	KODT	572	Computer Systems Design	2	0	2	KODE 423	KODT 571D
			TOTAL	19	6	21		
5th year 2nd sem.	EEDE	523	Industrial Management	3	0	3	5th year standing	-
	EEDT	521F	Seminars and Field Trips	0	3	1	For ECE candidates only	-
	EEDT	522	Contracts, Specifications, Ethics & ECE Laws	2	0	2	5th year standing	-
	ELDT	521D	Microwave & Carrier Communications Engineering (dsgn)	0	3	1	ELDT 553	ELDT 522
	ELDT	522	Microwave & Carrier Communications Engineering	2	0	2	ELDT 553	ELDT 521D
	ELDT	541D	Wire Communications Eng'g (dsgn)	0	3	1	ELDT 513	ELDT 542
	ELDT	542	Wire Communications Eng'g	2	0	2	ELDT 513	ELDT 541D
	ELDT	563	Data Communications	3	0	3	ELDT 513	-
	ELDT	581L	Broadcasting Engineering and Applied Acoustics (lab)	0	3	1	ELDT 553	ELDT 583
	ELDT	583	Broadcasting Engineering and Applied Acoustics	3	0	3	ELDT 553	ELDT 581L
	SSZX	003	Social Science (Philippine Government, New Constitution, Taxation and Land Reform)	3	0	3		-
			TOTAL	18	12	22		

POLICIES, STANDARDS AND GUIDELINES
for programs leading to the degree of

BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

GENERAL OBJECTIVE

To develop the Electronics and Communications Engineering Program, to specify minimum curriculum and laboratory equipment requirements and define the infrastructure that will allow the full development of the student to prepare him in his professional life as an engineer and as an effective member of society.

SPECIFIC OBJECTIVES

To provide the student with an education in the fundamentals of electronics and communications engineering that will allow him to be immediately competitive in industry or in graduate work while providing him with the best opportunity for achieving his full potential during his lifetime.

To develop a sense of professional responsibility and social awareness.

To provide practical applications and hands-on work as evidenced by laboratory, design, project study, computer exercises and practicum courses. These would help the student to work well whether independently or as part of a group.

Institutional electives are prescribed in order to give a certain degree of specialization so that institutions of learning will develop strengths in areas where they already have a certain degree of expertise.

Emphasis is given to the basic concepts. Previously identified courses are strengthened to take into account new developments. New courses and/or topics are introduced. As an example, a Mathematics course specifically for ECEs is prescribed so that the student's knowledge of the fundamentals may be enhanced. A course on Signals, Spectra and Signal Processing is also introduced. This is to allow the student to achieve a degree of knowledge compatible with international standards.

FIELDS OF SPECIALIZATION

- Broadcasting : Television, Radio, AM, FM, Cable TV(CATV), MMDS
- Telecommunications: Telephone, Data Communications and Networking, Microwave, Satellite, Optical fiber communications
- Semiconductor Device Fabrication/ Manufacturing
- Design: Devices, Circuits, Systems, VLSI, IC
- Computers: Programming, Interfacing
- Instrumentation, Telemetry
- Automation, Feedback, Process Control, Robotics
- Industrial Electronics
- Signal Processing: Speech, Image, Analog, Digital, Detection, Estimation
- Integrated Optics
- Medical/Biomedical Electronics

CAREER OPTIONS/OPPORTUNITIES

- Planning, Design, Engineering
- Manufacturing and Production
- Management and Supervision
- Academe (teaching and training)
- Research and Development
- Operation and Maintenance
- Sales, Marketing and Service

MINIMUM COURSE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

Classification/Field/Course	*Min Lec Hrs*	*Min Lab Hrs*	*Min Credit Units*
I. TECHNICAL COURSES			
A. Mathematics			
Algebra	3	0	3
Trigonometry	3	0	3
Analytic and Solid Geometry	3	0	3
Differential Calculus	3	0	3
Integral Calculus	3	0	3
Differential Equations	3	0	3
Probability and Statistics	2	0	2
ECE Mathematics	3	0	3
Sub-Total	*23*	*0*	*23*
B. Physical Sciences			
Chemistry	3	3	4
Physics 1	2	3	3
Physics 2	2	3	3
Sub-Total	*7*	*9*	*10*
C. Basic Engineering Sciences			
Engineering Drawing	0	6	2
Thermodynamics	3	0	3
Engineering Mechanics	5	0	5
Engineering Economy	3	0	3
Engineering Management	2	0	2
Computer Fundamentals and Programming	2	3	3
Strength of Materials	3	0	3
Environmental Science	3	0	3
Materials Science	3	0	3
Sub-Total	*24*	*9*	*27*

Classification/Field/Course	*Min Lec Hrs*	*Min Lab Hrs*	*Min Credit Units*
D. Professional Courses			
Circuits 1	3	0	3
Circuits Lab . 1	0	3	1
Circuits 2	3	0	3
Circuits Laboratory 2	0	3	1
Electronics 1	3	0	3
Electronics Laboratory 1	0	3	1
Electronics 2	3	0	3
Electronics Laboratory 2	0	3	1
Electronics 3	3	0	3
Electronics Laboratory 3	0	3	1
Energy Conversion	3	0	3
Energy Conversion Laboratory	0	3	1
Electromagnetics	3	0	3
Signals, Spectra, Signal Processing	3	0	3
Signals, Spectra, Signal Processing Laboratory	0	3	1
Communications Theory 1	3	0	3
Communications Laboratory 1	0	3	1
Communications Theory 2	3	0	3
Communications Laboratory 2	0	3	1
Communications Theory 3	3	0	3
Communications Laboratory 3	0	3	1
Communications Theory 4	3	0	3
Communications Theory 5	3	0	3
Communications Theory 5 Laboratory	0	3	1
Broadcast Engineering and Acoustics	3	0	3
Broadcast Engineering and Acoustics Laboratory	0	3	1
Logic Circuits and Switching Theory	3	0	3
Logic Circuits and Switching Theory Laboratory	0	3	1
Microprocessor Systems	3	0	3
Microprocessor Systems Laboratory	0	3	1
Control Systems	3	0	3
Control Systems Laboratory	0	3	1
Industrial Electronics	3	0	3
Industrial Electronics Laboratory	0	3	1
Data Communications	3	0	3
ECE Computer Applications	3	0	3
ECE Computer Applications Laboratory	0	3	1
ECE Laws, Contracts and Ethics	2	0	2
ECE Safety	2	0	2
Seminars and Field Trips	0	3	1
Practicum/Project Study	1	6	3
Sub-Total	*65*	*60*	*85*

Classification/Field/Course	*Min Lec Hrs*	*Min Lab Hrs*	*Min Credit Units*
E. Technical Electives			
ECE Electives	9	0	9
Sub-Total	*9*	*0*	*9*
TOTAL TECHNICAL COURSES			*154*
II. NON-TECHNICAL COURSES			
A. Languages, Humanities and Social Sciences			
English 1,2,3	9	0	9
Filipino 1,2	6	0	6
Social Sciences 1,2,3,4	12	0	12
Humanities 1,2	6	0	6
Life and Works of Rizal	3	0	3
Sub-Total	*36*	*0*	*36*
B. Miscellany			
P.E.			(8)
C.M.T.			(6)
Sub-Total			(14)
TOTAL NON-TECHNICAL COURSES			*36*
GRAND TOTAL			190

SUGGESTED CURRICULAR STRUCTURE FOR BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

FIRST YEAR

First Semester	Lec Hrs	Lab Hrs	Credit Units	Second Semester	Lec Hrs	Lab Hrs	Credit Units
Algebra	3	0	3	Analytic and Solid Geometry	3	0	3
Trigonometry	3	0	3	Social Science 1	3	0	3
Chemistry	3	3	4	Differential Calculus	3	0	3
Engineering Drawing	0	6	2	English 2	3	0	3
English 1	3	0	3	Filipino 2	3	0	3
Filipino 1	3	0	3	P.E.			(2)
P.E.			(2)	C.M.T.			(1.5)
C.M.T.			(1.5)				
Total	*15*	*9*	*18*	*Total*	*15*	*0*	*15*

SECOND YEAR

First Semester	Lec Hrs	Lab Hrs	Credit Units	Second Semester	Lec Hrs	Lab Hrs	Credit Units
Physics 1	2	3	3	Physics 2	2	3	3
Integral Calculus	3	0	3	Differential Equations	3	0	3
English 3	3	0	3	Humanities 2	3	0	3
Life and Works of Rizal	3	0	3	Social Science 3	3	0	3
Social Science 2	3	0	3	Computer Fund. and Programming	2	3	3
Humanities 1	3	0	3	P.E.			(2)
P.E.			(2)	C.M.T.			(1.5)
C.M.T.			(1.5)				
Total	*17*	*3*	*18*	*Total*	*13*	*6*	*15*

THIRD YEAR

First Semester	Lec Hrs	Lab Hrs	Credit Units	Second Semester	Lec Hrs	Lab Hrs	Credit Units
ECE Mathematics	3	0	3	Probability and Statistics	2	0	2
Materials Science	3	0	3	Engineering Mechanics	5	0	5
Circuits 1	3	0	3	Circuits 2	3	0	3
Circuits Lab. 1	0	3	1	Circuits Lab. 2	0	3	1
Electronics 1	3	0	3	Signals, Spectra, Signal	3	0	3
Electronics Lab. 1	0	3	1	Processing			
Electromagnetics	3	0	3	Signals, Spectra, Signal Processing Laboratory	0	3	1
Social Science 4	3	0	3	Electronics 2	3	0	3
				Electronics Lab. 2	0	3	1
				Thermodynamics	3	0	3
Total	*18*	*6*	*20*	*Total*	*19*	*9*	*22*

FOURTH YEAR

First Semester	Lec Hrs	Lab Hrs	Credit Units	Second Semester	Lec Hrs	Lab Hrs	Credit Units
Strength of Materials	3	0	3	Engineering Management	2	0	2
Communications	3	0	3	Industrial Electronics	3	0	3
Theory 1				Industrial Electronics Lab	0	3	1
Comm. Theory 1 Lab.	0	3	1	Communications Theory 2	3	0	3
Energy Conversion	3	0	3	Comm. Theory 2 Lab.	0	3	1
Energy Conv. Lab.	0	3	1	Logic Circuits and	3	0	3
Electronics 3	3	0	3	Switching Theory			
Electronics Lab. 3	0	3	1	Logic Circuits and	0	3	1
Engineering Economy	3	0	3	Switching Theory Lab.			
ECE Elective 1	3	0	3	Environmental Science	3	0	3
				ECE Elective 2	3	0	3
Total	*18*	*9*	*21*	*Total*	*17*	*9*	*20*

FIFTH YEAR

First Semester	Lec Hrs	Lab Hrs	Credit Units	Second Semester	Lec Hrs	Lab Hrs	Credit Units
Communications Theory 3	3	0	3	Communications Theory 5	3	0	3
Comm. Theory 3 Lab	0	3	1	Comm. Theory 5 Lab	0	3	1
Communications Theory 4	3	0	3	Seminars & Field Trips	0	3	1
Microprocessor Systems	3	0	3	Control Systems	3	0	3
Microprocessor Systems Lab.	0	3	1	Control Systems Lab	0	3	1
Broadcast Engg & Acoustics	3	0	3	Data Communications	3	0	3
Broadcast Engg & Acoustics Lab.	0	3	1	Practicum/Project Study	1	6	3
ECE Computer Applications	3	0	3	ECE Safety	2	0	2
ECE Computer Applications Lab	0	3	1	ECE Laws. Contracts and Ethics	2	0	2
ECE Elective 3	3	0	3				
Total	*18*	*12*	*22*	*Total*	*14*	*15*	*19*

COURSES DESCRIPTIONS FOR BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING

I. Technical Courses

A. MATHEMATICS

ALGEBRA. Set theory; real numbers; algebraic expressions and operations equations and inequalities; functions, relations and their graphs; systems of equations; exponential and logarithmic functions; combinatorial mathematics; matrices and determinants; progression; binomial theorem; mathematical induction.
Recommended Textbooks:
Algebra and Trigonometry by Leithold
College Algebra by C. Mijares

TRIGONOMETRY. Trigonometric functions; identities and equations; solutions of triangles; laws of sines; law of cosines; complex numbers; inverse trigonometric functions.
Recommended Textbooks:
Algebra and Trigonometry by Leithold
Plane and Spherical Trigonometry by Ryder

ANALYTIC AND SOLID GEOMETRY. Coordinate systems; equations and their loci; straight lines, conic sections and higher plane curves; transformation of coordinates; spherical trigonometry; transformation of coordinates in space; quadric surfaces.
Prerequisites: Algebra
Trigonometry
Recommended Textbooks:
Analytic Geometry by Fuller
Analytic Geometry by Purcell

DIFFERENTIAL CALCULUS. Functions; limit and continuity; derivatives and differentiation; partial derivatives; applications.
Corequisite: Analytic Geometry
Recommended Textbooks:
Calculus with Analytic Geometry by Edwards and Penny
Calculus and Analytic Geometry by Thomas and Finney

INTEGRAL CALCULUS. Anti-derivative; integration methods; definite integrals; multiple integrals; infinite series; applications.
Prerequisite: Differential Calculus

Recommended Textbooks:

Calculus with Analytic Geometry by Edwards and Penny
Calculus and Analytic Geometry by Thomas and Finney

DIFFERENTIAL EQUATIONS. Ordinary differential equations of the first order; linear differential equations with constant coefficients; simultaneous linear differential equations; applications.
Prerequisite: Integral Calculus
Recommended Textbooks:

Ordinary Differential Equations by Shapely Ross
Ordinary Differential Equations by Rainville and Bedient

PROBABILITY AND STATISTICS. Basic principles of statistics, charts, graphs, presentation and analysis of data averages, median, mode, deviations, probability, normal curves and applications.
Recommended Textbook:

Probability and Statistics for Scientists and Engineers by Walpole

ECE MATHEMATICS. Determinants and matrices; power series expansion; Fourier series; Fourier transform; Laplace transform; Hilbert transform; z-transform; complex variables; random variables; stochastic processes.
Prerequisite: Differential Equations
Recommended Textbooks:

Advanced Engineering Mathematics by Kreizig
Probabilities, Random Variables and Random Processes by Michael Flynn
Advanced Modern Engineering Mathematics by Glyn James

B. PHYSICAL SCIENCES

CHEMISTRY. Basic concepts of matter and energy; structure of atoms; chemical formulas and equations; periodic table; chemical bonds; chemical behavior; basic stoichiometry; solutions and gas laws calculations; thermochemistry; electrochemistry; nuclear chemistry.

PHYSICS 1. Mechanics; waves; sound; heat; work and energy.
Prerequisites: Algebra
Trigonometry

PHYSICS 2. Electricity and magnetism; light and optics; quantum mechanics.
Prerequisite: Physics 2

C. BASIC ENGINEERING SCIENCES

ENGINEERING DRAWING. Basic sketching and drafting; orthographic projection; descriptive geometry; isometric drawing and sectioning; assembly drawing; exploded views; fundamentals of computer-aided drafting.

Recommended Textbooks:

Computer-Aided Drafting with Autocad by Goetsch, 1990
Autocad Reference Manual or equivalent

ENGINEERING MECHANICS. Statics and dynamics: Operations with the free body concept; equilibrium of coplanar and noncoplanar force systems; analysis of frames and trusses; friction; centroids and moments of inertia; motion of particles and rigid bodies; force, mass and acceleration; work and energy; impulse and momentum.

Prerequisites: Integral Calculus
Physics 1

Recommended Textbook:

Engineering Mechanics : Statics and Dynamics by F. Singer

STRENGTH OF MATERIALS. Axial stress and strain; stresses for torsion and bending; combined stresses; beam deflections; determinate and indeterminate beams; elastic instability.

Prerequisite: Engineering Mechanics

Recommended Textbook:

Strength of Materials by Singer

THERMODYNAMICS. Laws of thermodynamics; energy and property relationships; ideal gas laws; thermodynamic processes and cycles; heat transfer basics.

Prerequisites: Physics 2
Integral Calculus

COMPUTER FUNDAMENTALS AND PROGRAMMING. Introduction to computer systems; fundamentals of algorithms; high level language; programming applications.

Recommended Textbooks:

The C Programming Language by Kernighan and Ritchie
Turbo C++ User's and Reference Manual by BORLAND

ENGINEERING ECONOMY. Principles of accounting; time value of money; capital investment decision criteria; applications.

Prerequisite: Preferably 4th Year Standing

Recommended Textbooks:

Engineering Economy by H. Sta. Maria
Engineering Economy by Paul de Garmo, 1993

ENGINEERING MANAGEMENT. Industrial organization and management concepts, theories, principles, functions and practices; human behavior; introduction to decision- making tools; PERT-CPM; case studies.
Prerequisite: Preferably 4th Year Standing

MATERIALS SCIENCE. Physics of materials; properties of engineering materials (polymers, ceramics, glasses, semiconductors) including mechanical, acoustical, electrical, magnetic, chemical, optical and thermal properties.
Prerequisite: Chemistry

ENVIRONMENTAL SCIENCE. Effects of engineering works on the environment; ecology, environmental economics, environmental laws and policies; waste treatment; water and energy management; environmental engineering practices; international policies on electromagnetic interference.
Recommended Textbook:
National and International Regulations

D. PROFESSIONAL COURSES

CIRCUITS 1. Fundamental relationships in circuit theory; mesh and node equations; resistive networks; network theorems; solution of network problems using Laplace transform; transient analysis; methods of circuit analysis.
Prerequisite: Physics 2
Corequisite: ECE Mathematics
Recommended Textbooks:
Engineering Circuit Analysis, 4th Edition by Hayt and Kemmerly
Basic Electric Circuit Analysis, 2nd Edition by Johnson and Hilburn
Alternating Current Circuits, 4th Edition by Kerchner and Corcoran
Electric Circuits by Siskind

CIRCUITS 2. Complex algebra and phasors; simple AC circuits, impedance and admittance; mesh and node analysis for AC circuits; AC network theorems; power in AC circuits; resonance; three-phase circuits; transformers; two-port network parameters and transfer function.
Prerequisite: Circuits 1
Recommended Textbooks:
Engineering Circuit Analysis, 4th Edition by Hayt and Kemmerly
Basic Electric Circuit Analysis, 2nd Edition by Johnson and Hilburn

Alternating Current Circuits, 4th Edition by Kerchner and Corcoran
Electric Circuits by Siskind

ELECTRONICS 1. Elementary semi-conductor theory; diode and transistor models; diode circuit analysis and applications; transistor biasing; small signal analysis; large signal analysis; differential amplifiers; transistor amplifiers; Boolean logic; transistor switch; combinational logic circuits.
Corequisite: Circuits 1
Recommended Textbooks :
Electronic Circuit and Devices by Boylestad and Nashelsky
Basic Electronics by Grob

ELECTRONICS 2. High frequency transistor models; analysis of transistor circuits; feedback and operational amplifiers; combinational and sequential devices for logic circuits; integrated circuit families.
Prerequisite: Electronics 1
Recommended Textbooks:
Electronic Circuit and Devices by Boylestad and Nashelsky
Electronic Circuit Design by Savant and Roden
Integrated Electronics by Millman and Halkias
Electronic Circuits by Schilling and Belove
The Art of Electronics by Horowitz and Hill

ELECTRONICS 3. Switching operation of transistors; basic circuits for digital networks; passive and active wave shaping; pulse and digital circuits; clock circuits.
Prerequisite: Electronics 2
Recommended Textbooks :
Electronic Circuit and Devices by Boylestad and Nashelsky
Electronic Circuit Design by Savant and Roden
Integrated Electronics by Millman and Halkias
Electronic Circuits by Schilling and Belove
The Art of Electronics by Horowitz and Hill

ELECTROMAGNETICS. Vector analysis; steady electric and magnetic fields; dielectric and magnetic materials; coupled circuits; magnetic circuits; time-varying fields; Maxwell's equations; field and circuit relationships.
Corequisite: Circuits 1
Recommended Textbooks :
Engineering Electromagnetics by Hayt
Electromagnetics by Kraus

ENERGY CONVERSION. Principles of energy conversion : electromechanical, photoelectric, photovoltaic, electrochemical, etc.; motors, generators, and transformers; dynamic analysis.

Prerequisites : Circuits 2
Electromagnetics

Recommended Textbooks :
Electric Machinery by Fitzgerald, 1992
Electrical Machines by Siskind

SIGNALS, SPECTRA, AND SIGNAL PROCESSING. Review of z transform; convolution; chirp-Z transform; wavelet transform; FIR filters; IIR filters; random signal analysis; correlation functions; DFT; FFT; spectral analysis; applications of signal processing to speech, image, etc.

Prerequisites : Probability and Statistics
ECE Mathematics

Recommended Textbooks:
J.G. Proakis and D.G. Manolakis, "Digital Signal Processing", Third Edition, Prentice Hall, 1996
Signal Processing by Oppenheim
Introduction to Signals and Systems by Kamen, 1990

COMMUNICATIONS THEORY 1. Bandwidth; linear modulation circuits; angle modulation circuits; phase locked loop; pulse modulation; multiplexing; noise.

Prerequisite: Probability and Statistics
Corequisite: Signals, Spectra, and Signal Processing
Recommended Textbooks :
Communication Systems by A. Bruce Carlson
Electronics Communication by Kennedy
Electronics Communication by W. Stanley
Electronic Communications by Robert L. Shrader

COMMUNICATIONS THEORY 2. Review of random variables, bit error rate; matched filter concept; Digital and other modulation techniques, ASK, FSK, PSK systems; signal space concepts; generalized orthonormal signals; information measures-entropy; channel capacity concept; efficient encoding; error correcting codes information theory; data compression; telephony fundamentals.

Prerequisite: Communications Theory 1
Recommended Textbooks:
Advanced Electronic Communications by Tomasi, 1995
Electronic Communications by Roddy and Coolen, 1995

COMMUNICATIONS THEORY 3. Transmission media; radiowave propagation. wire and cable transmission systems; fiber-optic transmission system; transmission lines and antenna systems.

Prerequisite: Communications Theory 1

Recommended Textbooks :

Electronics Communications Handbook by English
Communications Sourcebook by Parker
Optical Fiber System by Senior
Fibre Optic Cables by Siemens
Antennas by Kraus
ARRL Antenna Book
Electronic Communications by Roddy & Coolen
Transmission Lines and Networks by Johnson
Electronics Communication by Kennedy

COMMUNICATIONS THEORY 4. Signal transmission modes; spread spectrum modulation system; terrestrial microwave; satellite systems; switching and handling systems; circuit switching, message switching, packet switching; telephone systems; land mobile systems and standards; paging systems; cellular radio systems; PSTN; OSI; ISO.

Prerequisite: Communications Theory 2

Recommended Textbooks :

Electronics Communications Handbook by English
Communications Sourcebook by Parker
Telecommunications Switching Principles by Hills
Electronic Communications Systems Fundamentals Through Advanced by Tomasi, 1995

COMMUNICATIONS THEORY 5. Communication systems analysis and design; operating performance and interface standards for voice and data circuits; private communication systems planning and design; communications plant design and construction to include foundations and structure; outside plant engineering; surveying.

Prerequisite: Communications Theory 4

Recommended Textbooks:

Reference Data for Radio Engineers by Van Valkenburg
Electronic Designers Handbook by Landee
Microwave Engineering Design Considerations by Lenkurt

BROADCAST ENGINEERING AND ACOUSTICS. Filters and oscillators; radio frequency power amplifiers; mixers; modulation and demodulation circuits; transmitters; studio acoustics; recording and reproduction of audio and video by tape, disc and film.

Prerequisite: Transmission Media

Recommended Textbooks:

Philippine Electronics Code Volume I Safety
KBP Technical Standards and Operating Requirements for Broadcast Stations in the Philippines National Association of Broadcasters (NAB) Handbook
Basic Television and Video Systems by Bernard Grob

LOGIC CIRCUITS AND SWITCHING THEORY. Review of number systems, coding and Boolean algebra; inputs and outputs; gates and gating networks; combinational circuits; standard form; minimization; sequential circuits; state and machine equivalence; asynchronous sequential circuits; race conditions; algorithmic state machines; design of digital sub-systems.
Corequisite: Electronics 2
Recommended Textbooks :

Digital Design by M. Morris Mano, 1984
Introduction to Switching Theory and Logical Design by F. Hill and G. Peterson
Digital Integrated Electronics by H. Taub and D. Schilling
Digital Computer Fundamentals by Thomas Bartee
Digital Logic and State Machine Design by David J. Comer
Logic Databook by National Semiconductor
TTL data Manual by Signetics

MICROPROCESSOR SYSTEMS. Survey of microprocessor/microcontroller organizations; microcomputer architecture; microprocessor programming; interfacing techniques; bus standards; microcomputer development systems and other tools for design; student project.
Recommended Textbooks :

The 8088 Microprocessor Programming, Interfacing, Software, Hardware, and Applications by Singh and Triebel
The INTEL Microprocessors 8086/8088, 80186, 80286, 80386 and 80486 by Barry Brey
INTEL Microprocessor Reference Manual
Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design by Yu-cheng and Gibson
Design with Microcontrollers by Peatman
Microprocessors and Interfacing by Hall
Interfacing Techniques in Digital Design: With Emphasis on Microprocessors by Ronald L. Krutz

CONTROL SYSTEMS. Transfer functions; block diagrams; signal flow graphs; root locus; Bode, Nyquist and Polar plots; sensitivity and stability criteria; linear feedback systems; compensation techniques; PLC.

Prerequisite: Circuits 2

Recommended Textbooks :

Control Systems Engineering by Nise
Control Systems by Franklyn and Powell

INDUSTRIAL ELECTRONICS. Theory and operating characteristics of electronic devices and control circuits for industrial processes; industrial control applications; electronic instrumentation; transducers; data acquisition systems.

Prerequisites : Energy Conversion
Electronics 2

Recommended Textbooks :

Industrial Electronics and Robotics by Schuler
Electronic Devices and Circuit Theory by Boylestad
Power Control Electronics by Larson
Industrial Solid State Electronics by Maloney
The Art of Electronics by Horowitz

DATA COMMUNICATIONS. Data communication systems; terminals, modems; terminal control units; multiplexers; concentrators; front-end processors; common carrier services; data communication system design; networking.

Prerequisite: Communications Theory 1

Recommended Textbooks :

Advanced Electronic Communications by Tomasi
Data Networks by Black
Data and Computer Networks by Stallings
Data Communications by Tugal and Tugal

ECE LAWS, CONTRACTS AND ETHICS. Contracts; warranties; liabilities; patents; bids; insurance; other topics on the legal and ethical positions of the professional engineer.

Prerequisite: 5th Year Standing

Recommended Textbooks :

Philippine Engineering Laws
Obligations and Contracts

SEMINARS AND FIELD TRIPS. Seminars and lectures on current topics on electronics and communications engineering development; field trips to different companies and plants dealing with electronics and communications facilities.

Prerequisite: 5th Year Standing, i.e., must have finished at least 50% if first semester , fifth year subjects.

ECE COMPUTER APPLICATIONS. Computer-aided applications in circuit, communications, electronics, or other principles and programs by students in C language; use of computers using available software (Matlab, Electronic Workbench, PSPICE, etc...) ; numerical methods.

Recommended Textbooks :

MATLAB(or equivalent) Reference Manual and Users Manual
Numerical Methods
Electronic Workbench(or equivalent) Reference Manual
PSPICE(or equivalent) Reference Manual
The C Programming Language by Kernighan and Ritchie
Turbo C++ User's and Reference Manual by BORLAND.

ECE SAFETY. Chemical Safety; Electrical Safety to include TVSS and grounding, electrostatic discharge; Personnel Safety/Health including Worker Protection and Introduction to Ergonomics; environmental related safety measures such as water and energy consumption; EMI/EMC; SOLAS.

Recommended Textbooks :

Philippine Electronics Code Volume I Safety
Safety Standards
ITU Regulations

PRACTICUM/PROJECT STUDY. Industry exposure of students for them to match school acquired competencies and knowledge to the realities and problems of industry. This may include involvement in industry's energy and manpower requirements,. development and research concerns, training, applications of principles, environmental concerns, ethical and behavioral concerns, decision making, equipment and materials management. Project study related to the industry is an alternative; methods of research and principles of electronic design.

F. SUGGESTED ELECTIVE COURSES :

ECE CAD. Formulation of Network and circuit Equations; methods of solution; analysis of dc and ac, linear and nonlinear circuits; transients; steady-state; modeling of devices; simulation of analog and digital circuits; IC's; use of CAD software in the analysis, synthesis and design : Nodal, Orcad SDT, VST, PLD, PCB; PSPICE; Electronic Workebench; Microcap; Edwin; EESOF; Maple V; Protel; Matlab; Mathematica; Mentor Graphics; etc.

Prerequisite : ECE Computer Applications

POWER ELECTRONICS. Application of semiconductor components and devices to power system problems; power control; conditioning; processing and switching.
Prerequisites: Electronics 3
Energy Conversion

SOLID STATE PHYSICS AND FABRICATION. Conduction mechanisms in semiconductors and metals; semiconductor junction phenomena; optical absorption and emission processes; paramagnetic resonance phenomena; ferromagnetic devices; semiconductor fabrication techniques.
Prerequisites: Electromagnetics
Electronics 1

INSTRUMENTATION AND CONTROLS. Detectors for the measurement of process variables; analysis and synthesis of performance characteristics of control systems; electronic, magnetic, hydraulic and mechanical control devices.
Prerequisite: Control Systems

DIGITAL COMMUNICATIONS. Pulse transmission; spectra of digital signals; base-bond digital communication; digital modulation; sampling and organization; pulse code modulation; multiplexing data communication networks.
Prerequisite: Principles of Communications

NAVIGATIONAL AIDS. Principles and applications of electronic devices used as aids to navigation in the air, sea, land and space.
Prerequisite: Principles of Communications

COMPUTER SYSTEMS. Information representation in computers; fundamentals of computer organization structure and technologies of input/output and memory systems; instruction sequencing and execution; addressing; instruction formats; study of a small computer system; recent developments.
Prerequisite: Computer Fundamentals and Programming
Corequisite Electronics 2

I/O AND MEMORY SYSTEMS. Intersystem communications; interrupt and input/output; peripherals and interfacing; microprocessor input/output systems; memory approaches for large systems and related circuitry.
Prerequisite: Logic Circuits and Switching Theory

COMPUTER SYSTEM ARCHITECTURE. Von Neumann machines; instruction set; interpretation; control structures; interrupts; addressing techniques; I/O and memory systems; mainline computers; pipeline computers; multiple address machines; character machines; protection and performance; character machines; multiprocessors and networks; microprogramming; non-Von Neumann machines.
Corequisite: Logic Circuits and Switching Theory

DATA STRUCTURES AND ALGORITHMS ANALYSIS. Linear data structures such as arrays, stacks, queues, linked lists; non-linear data structures such as generalized lists, trees and graphs; operations on these structures using algorithms such as deletions, insertions and traversals; elementary complexity analysis.
Prerequisite: Computer Fundamentals and Programming

COMPUTER SYSTEMS ORGANIZATIONS WITH ASSEMBLY LANGUAGE. Internal number representation and arithmetic; computer structure and machine language; assembly language concept.
Prerequisite: Computer Fundamentals and Programming

STRUCTURE OF PROGRAMMING LANGUAGES. Programming language concepts; data types and structures; control structures and data flow; run-time consideration; interpretative languages; introduction to lexical analysis and parsing.
Prerequisite: Data Structures and Algorithms Analysis

OPERATING SYSTEMS. Review of instruction sets, I/O interrupt structure, addressing schemes, microprogramming; dynamic procedure activation; system structure; evaluation; memory management; process management; recovery procedures.
Prerequisite: Structure of Programming Languages

DIGITAL CONTROL SYSTEMS. Signal conversion and processing; digital signals and coding; data conversion and quantization; D/A; A/D; zero order hold; Z-transform; signal flow graphs applied to digital systems; state variable technique; stability; digital simulation; controllability and observability.
Prerequisites: ECE Mathematics
Control Systems

MEDICAL AND BIOMEDICAL ELECTRONICS. Medical and Bio-medical applications of Electronics; sensor, devices, equipment and systems.

MINIMUM LABORATORY REQUIREMENTS FOR BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS

CIRCUITS 1

1 Familiarization with DC Equipment
2 Parallel & Series connection of linear resistors
3 Delta-Wye transformation of resistive networks
4 DC power measurement
5 Kirchhoff's Law
6 Superposition Law
7 Thevenin's Theorem
8 Bridge circuits
9 RC/RL Time constant curve
10 Maximum Power Transfer

CIRCUITS 2

1 Familiarization with AC instruments
2 Impedance of RC circuits
3 Impedance of RLC circuits
4 Power dissipation in AC circuits
5 Measurement of Power Factor
6 Three Phase circuit
7 Power in 3-phase balanced load
8 Transformer
9 Frequency response of RL and RC
10 Maximum Power transfer

ELECTRONICS 1

1 Solid state Diode familiarization
2 Diode Applications
3 Transistor familiarization
4 Transistor applications
5 JFET familiarization and characteristic curves
6 BJT familiarization and characteristic curves
7 Pre-amplifiers

ELECTRONICS 2

1 Frequency response of a transistor amplifier
2 Cascaded transistor amplifier
3 The differential amplifier
4 The operational amplifier
5 The transistor as a switch
6 Familiarization with digital circuits
7 Filters

ELECTRONICS 3

1 Passive and active waveshaping circuits
2 Basic logic circuits
3 Digital Integrated Circuits Logic Gates
4 Advanced digital integrated circuits
5 Flip Flops
6 Clock Circuits
7 Monostable and Astable multivibrators

ENERGY CONVERSION

1 Starting and speed control of a shunt motor
2 Load characteristics of series, shunt and compound motors (or alternative)
3 Characteristics of DC generators
4 Parallel operation of separately excited generators
5 Single-phase transformer
6 Three-phase transformer connection
7 Three-phase alternator (synchronous generator)
8 Synchronous motor (or alternative)
9 Three-phase Squirrel Cage Induction Motor
10 Single-phase Induction Motor

MICROPROCESSOR SYSTEMS

1 Development System familiarization
2 I/O Execution
3 Interrupts
4 Adding memory to a microprocessor system
5 Design of a Parallel Output port

6 Design of a Parallel Input port
7 Design of Serial I/O port

SIGNALS, SPECTRA AND SIGNAL PROCESSING

1 Periodic Signals
2 Non-periodic Signals
3 Computation of Transforms
4 Sampling and Quantization
5 Measurements on Filter Response
6 FIR Filter Analysis and Design
7 IIR Filter Analysis and Design

List of Equipment :

PC (with at least a 386 processor, 4M RAM, VGA color monitor, mouse)
Software - Matlab (or equivalent software, e.g., Mathematica, Mathcad)
Power Supply
ADC/DAC system to interface with PC (a Data Acquisition system may be used)
CRO
Audio Signal generator
Sound Blaster
Headphone
Speaker
Training module in signal processing such as TIMS equipment (or equivalent) having : adder, tunable LPF, headphone amplifier, VCO, pulse oscillator

FEEDBACK AND CONTROLS LABORATORY

1 Time Domain Response of First and Second Order Systems. Modeling and Simulation using Matlab
2 Frequency Response Design using Matlab
3 Root Locus Design using Matlab
4 Characteristics of P, PD, PI, PID Controllers
5 Application of P, PI, PD, PID Controllers to Simulated Control System
6 Characteristics, Transient Response, and closed loop Control of a DC Motor
7 Open loop and Closed loop Control of the Output Voltage of a Loaded Generator

8 The PLC
9 Project (This may take the place of any two experiments)

List of Equipment :

PC (with at least a 386 processor, 4M RAM, VGA color monitor, mouse)
Software - Matlab (or equivalent)
PLC
CRO
Audio signal generator
Motor-generator set
PC interfaced Data Acquisition System
Components : Op-amps, resistors, capacitors

ECE COMPUTER APPLICATIONS

List of Exercises

C-Language Programming :

1 Determination of roots of algebraic equations and transcendental equations
Newton's method, etc...
2 Solution to simultaneous linear and non-linear equations
Gauss; Newton-Raphson method
3 Applications to electric and electronic circuits

DC and AC analysis using Nodal Analysis Matlab (or equivalent software, e.g., Mathematica, Mathcad) Applications:

1 Determination of roots of equations
2 Vector and Matrix Operations
3 Solution to simultaneous equations
4 Graphics
5 Applications to network analysis

Electronic Workbench or Equivalent Software, e.g., PSPICE, MICROCAP, etc...:

1 DC circuit simulation
voltage, current, and resistance measurements
2 AC circuit simulation
voltage, phase measurements
3 Wave-shaping Circuits Simulation
Rectifiers, clippers, integrators, differentiators

4 OP-AMP circuit simulation
5 Transient response
6 Tuned-Circuit simulation
7 Frequency response using the BODE plot

List of equipment used for the exercises :

PC (with at least a 386 processor, 4M RAM, VGA color monitor, mouse)
Software : BORLAND Turbo C or equivalent
Matlab, Mathcad, or Mathematica
Electronic Workbench Student Edition (or equivalent, e.g., PSPICE, MICROCAP,etc...)

LOGIC CIRCUITS AND SWITCHING THEORY

1 Diode digital logic gates
2 Transistor digital logic gates
3 Integrated digital logic gates
4 Flip-flops
5 Registers
6 Counters (binary, ripple, decade, etc...)
7 Logic Circuit Project Design, construction and testing

List of Equipment :

LAB-VOLT Experiment Boards (or equivalent)
Universal Assembly Board K
LED Board L
Switches (SPST, SPDT, DPST, DPDT, PBNO, PBNC)
NAND and J-K flip-flops Board E
IC timing Circuit Board D
DC power supply
VOM
Oscilloscope
Connecting leads
Logic Probe
Experiment Board

Components :

Resistors (1W)
Silicon Diodes (1N4004)
Transistors (2N2219A)
Assorted ICs in DIP

BROADCAST ENGINEERING AND ACOUSTICS

Four performing laboratories and a design project equivalent to three performing experiments.

1 Sound level measurements
sound measurements in different acoustical environments
2 Microphones
Characteristics : frequency response, directional , characteristics
3 Speakers and speakers
Determination of frequency response
4 Characteristics of Mixers, Tone Controls, and Crossover Networks.
5 Design project to cover at least two of the following areas :
a) AM or FM radio station
b) TV station
c) CATV

Equipment required :
Signal Generators
Function Generators
Oscilloscopes
Sound Level Meters
Multimeters
Microphones
Speakers
Op-amps

Materials :
PCB
semiconductors
capacitors : fixed
resistors : fixed and variable
inductors
audio transformers

COMMUNICATIONS THEORY I

1 Passive, Active Filters, Tuned Circuits
2 AM Transmitter
3 Frequency Modulation
4 Pulse Amplitude Modulation
5 Diode Detection
6 Time Division Multiplexing
7 Frequency Division Multiplexing

Project : Construction of Supeheterodyne Receiver

Equipment:

- Superheterodyne Module
- Digital Frequency Meter
- RF voltmeter
- RF Signal Generator
- Power Supply
- Oscilloscope
- Audio Generator
- Function Generator
- Multimeter

Materials :

- IC's
- Semiconductors
- Potentiometers
- Resistors
- Capacitors
- PCB/Breadboard
- Connecting Wires

COMMUNICATIONS THEORY 2

1 PAM
2 Noise
3 FSK (ASK, PSK)
4 PCM
5 Error Detection and Correction
6 Telephony

Project : To illustrate the integration of Communications theory to specialized communications areas such as :

- data compression
- image processing
- signal processing
- coding and information theory

Equipment :

- Frequency Meter
- RF voltmeter
- RF Signal Generator
- Power Supply
- Oscilloscope
- Audio Generator
- Function Generator
- Multimeter

Materials :

IC's
Semiconductors
Potentiometers
Resistors
Capacitors
PCB/Breadboard
Connecting Wires

COMMUNICATIONS THEORY 3

1 Transmission Lines
2 Antennas
3 Measurement of Frequency, Wavelength, and Phase Velocity in Waveguides
4 Generation of Microwaves
5 Detection of Microwaves
6 Attenuation Measurements
7 Optical Fibre System : numerical aperture, attenuation, modal theory.

Equipment needed :

Training modules in Transmission lines, Antennas, Microwave, and Optical Fibre Communication systems

COMMUNICATIONS THEORY 5

Design of a Communication System

資料12．フィリピン国の工科大学教育事情

Polytechnic University of the Philippines

College of Engineering and Architect, Pureza St,. Sta. Mesa, Manila

Contactpersons： Mr. Gedaria, Dean,

Ms. Maria Elena Noriega, Chairperson, Electronicand Communicatins

入学選抜方法：高校の成績とPUPの入学試験による。入学試験科目はIQテスト、数学、英語、適性試験、面接である。工学部の合格最低点は85点。

入学志願者数：コンピュータコースが最も難しく３倍以上の応募者で合格最低点が90点。２番目が電子通信コースで３倍以上、合格最低点が87点である。

学生の男女比：60：40（工学部全体）、50：50（コンピュータ、電子通信）

ドロップアウト：５年間で10%（工学部全体の学生数は約5,000人）

メカトロニクスコースの設立を計画しており、この実現に多くの困難があるが、既存の学科では教官も育っており、学生の質もよく、JICAから供与された教育機材もよく整備され使われている。

教育機材は電子、通信ともJICAから供与された機材により充実している。主なものはOcsilloscope、Function Generator、Power supply、などの低周波の計測機器がある。通信用にTVトレーナー、マイクロウェーブトレーナー、パルス回線トレーナー、ラジオ受信機トレーナー、FM/AM信号発生器、スペクトラムアナライザー、オシロスコープ、周波数カウンタ等。

言語は教科書等は英語、タガログ語であるが、その説明はタガログ語が使われている。

電子通信コースの選択科目に電子航法援助装置がある。

元はマネージメント分野から始まった学校で、工学分野の歴史は浅いが日本の協力により急速に発展している。

５年間で卒業できない学生のために１年修了者に Junior technician、２年修了者に Senior technician、３年修了者に Diplomatechnoogy、４年修了者に Diplomaengineerの資格が与えられる。

University of the East

Caloocan Campus

Electronicsand Communications course

Chairperson : Ms. Mirian Borja

入学選抜方法：National Secondary Achievement Test(数学、英語、物理、化学）と入学試験（数学、英語、物理、化学）の成績による。

テクニカルパネルの標準カリキュラムに加え、選択科目としてECECAD、デジタル通信、航

決援助システム、計装制御を用意している。

実験機材は学生の数に比べ不足している。通信用の実験機材はトレーナーが主であるが、スペクトラムアナライザーやネットワーク／プロトコールアナライザーなど新しい機材も用意している。

電子通信コースには約600人が入学し、3年生になると約300人、卒業するのは120人ぐらいである。

在学生の就職のために学内でJob fairを行い、就職斡旋を行っている。

Mapua Institute of Technology

Electronicsand Communications Engineering

Prof. Masil

・入学志願者の倍率は約3倍
・全体で約3,000人の入学者のうち、卒業するのは約1,000人
・理論／実技の割合は70：30
・40人クラスに8セットの実験機材が標準であるが実際は数量で不足している
・教材は英語
・学生の就職は企業実習などの機会に決まることが多い
・PRC 80%パス

FEATI University

Prof. Ugaldo

戦後、最初に設立された工科系私立大学で大学と職業訓練の両方の機能を持っている。空軍との人的な関係が強く、航空エンジンや航空工学など機械系は非常に充実している。

University of the Philippines

College of Engineering

Dr. Reynaldo B. Vea, Dean,

国を代表する国立大学だけあって他の大学に比べ格段に実験設備は整っており、充実している。電子通信コースにはマイクロ・エレクトロニクス、通信、コンピュータネットワーク、パワーエレクトロニクス、ロボット・制御、デジタル通信処理の各実験室を持っており、学生数の増加に伴い、実験室の増設を行っている。

現在使われているマイクロ・エレクトロニクスの素子はZ-80、マイクロコントローラーモトローラHC11、モトローラ6800、68000、インテル80Xシリーズ、デジタル信号処理にモトロー

ラ56000、テキサスインスツルメントTMS-30+ を主に使用。

すべての大学に共通事項

入学資格：10年の初等中等教育終了者

Technical Panel for Engineering, Architectureand Maritime Education の Committeeon Electronics and Communications Engineering に定められたカリキュラムのスタンダードに従っている。

Tentative Annual Training Plan for the project of
"Upgrading Human Resource Development for ANSS at the CATC in Manila"

June 1997

	Course	1 Jan.	2 Feb.	3 Mar.	4 Apr.	5 May	6 June	7 July	8 Aug.	9 Sept.	10 Oct.	11 Nov.	12 Dec.	remarks
Fundamental course	Fundamental Training	----------	----------	----------	----------	->								1 course 18weeks* Persons
	A/G·NDB Specialist Training					<----	---->							1 course 6weeks * Persons
Specialist course	ILS		<----	---->						<----	---->			2 course 5weeks* Persons
	VOR			<----------	->			<----------	->			<----	---->	3 course 5weeks* Persons
	DME	<----------	->		<----	---->			<----	->				3 course 5weeks* Persons
	RADAR					<----	----------	---->			<-	----------	---->	2 course 3weeks* Persons
Upper class course														
Dormitory	Dormitory of trainee													

資料14. フィリピン国における無線施設整備状況

1. NAVAIDS施設の整備状況

（1）現状

装置名	施設数	備　　考
VOR	29施設	V／D：23、VOR単独：6
DME	38施設	V／D：23、ILS用：13、DME単独：2
LLZ	13施設	
GS	11施設	
NDB	30施設	
その他	2施設	MM：1、OM：1

（2）今後整備計画がある施設

装　置　名	施設数
VOR単独	3施設
VOR／DME	4施設
DME単独	2施設
DME付加	5施設
NDB	10施設

（3）整備計画がある施設を含めた総計

装置名	施設数	備　　考
VOR	36施設	V／D：32、VOR単独：4
DME	49施設	V／D：32、ILS用：13、DME単独：4
LLZ	13施設	
GS	11施設	
NDB	40施設	
その他	2施設	MM：1、OM：1

2. レーダー関係施設の整備状況

(1) 航空路用レーダー施設

施設名	現状	将来
Tagaytay	ARSR SSR RML	ARSR SSR RML
Manila AFC	RML RDP FDP	RML RDP FDP
Laoag	M－SSR	M－SSR
Mt.Magic Cebu	M－SSR	M－SSR
Puerto Princesa	――――	M－SSR
General Santos	――――	M－SSR

(2) 空港用レーダー施設

施設名	現状	将来
Manila RADAR	ASR SSR TRDPS	ASR SSR TRDPS
Mactan	ASR SSR TRDPS	ASR SSR TRDPS
Subic	ASR SSR TRDPS	ASR SSR TRDPS
Laoag	――――	TRDPS
Clark	――――	TRDPS
Bacolod	――――	TRDPS
Tacloban	――――	TRDPS
Zamboanga	――――	TRDPS
Davao	――――	TRDPS

資料15. フィリピン国サイト別ANSS職員配置状況

交通名、サイト名	VOR	DME	LLZ	GS	TDME	MM	OM	NDB	ASR	SSR	TRDP	ARSR	SSR	RML	RDP	職員数
ALABAT								1								2
ALLAH VALLEY								1								
BACOLOD	1	○	1	1	1						○					8
BAGUIO	○	○						1								12
BALESIN	○															1
BASCO		1						1								2
BASILAN	○	○														
BUTUAN	1	1														
CABANATUAN	1	1														4
CAGAYAN DE ORO	1	1	1	1	1											10
CAGAYAN DE SULU		○						○								
CALBAYOG								○								
CATARMAN								○								
CATICLAN	○															
CAUAYAN	○	○						1								2
CLARK	1	1	2	2	2			1			○					
COTABATO	1	1														4
DAVAO	1	1	2	2	2			1			○					27
DIPOLOG	○	○						1								
DUMAGUETE	1	○														4
GENERAL SANTOS	2	2	1		1			1					○			3
ILIGAN								○								
ILOILO	1	1														11
JOLO								1								
JOMALIG	1	1														
JOVELLAR								1								
KALIBO	1	1						1								3
LAOAG	1	1						1			○		1			17
LEGASPI	1	1														8
LIPA	1	○						1								
LUBANG	1	1														2
MACTAN(NAVAIDS)	1	1	2	2	2											13
MACTAN(NDB)								1								3
MACTAN(RADAR)									1	1	1					
MACTANその他																38
MAMBURAO	○															
MANILA(NAVAIDS)	1	1	2	1	2	1	1	2								18
MANILA(RADAR)									1	1	1					18
MANILA AFC														1	1	31
MANILAその他																31
MARINDUQUE								○								2
MASBATE	1	○														2
MT.MAGIC													1			9
NAGA	1	1														4
ORMOC								○								
OZAMIS								○								
PAGADIAN								1								4
PLARIDEL								1								3
PUERTO PRINCESA	1	1						2					○			6
RIZAL								1								1
ROMBLOM								○								2
ROSARIO								1								4
ROXAS	1	○						1								7
SAN FERNANDO	1															5
SANGA-SANGA		1						1								
SAN JOSE	1	1														3
SIARGAO								○								
SORSOGON								○								
SUBIC	1	1	1	1	1			1	1	1	1					
SURIGAO								1								
TACLOBAN	1	1									○					10
TAGAYTAY												1	1	1		26
TAGBILARAN		○														2
TANDAG								1								3
TUGUEGARAO	1	1														4
VIRAC								1								1
ZAMBOANGA	1	1	1	1	1			1			○					23
その他																61
現状設置数量	29	25	13	11	13	1	1	30	3	3	3	1	3	2	1	
今後整備計画数量	7	11	0	0	0	0	0	10	0	0	6	0	2	0	0	
設計	36	36	13	11	13	1	1	40	3	3	9	1	5	2	1	454

○印: 今後整備計画が予定されている施設


JICA