

FACULTY OF FISHERIES AND MARINE SCIENCE

Introduction

The faculty of Fisheries and Marine Science had its origin in 1974 when the Division of Fisheries and Marine Science was established under the Faculty of Veterinary Medicine and Animal Science. The Diploma in Fisheries programme was subsequently offered in the 1974/75 academic year. On 1st May, 1979 the Division was officially raised to the status of a full faculty thus making the Faculty of Fisheries and Marine Science the eighth faculty established at Universiti Pertanian Malaysia. A degree programme, Bachelor of Science (Fisheries) was offered on the establishment of the new faculty.

Objectives

The faculty plays a direct and indirect role in national development by stimulating and supporting the development of the fisheries industry through its activities which include the following:

- a) To train professional and sub-professional manpower requirement to the fisheries sector and other agencies involved in the utilization of the aquatic resources.
- b) To conduct basic and applied research to solve current problems in the fishing industry and to develop new technology appropriate to local situation.
- c) To provide advisory and consultancy services to facilitate rapid transfer of new technology to the industry.
- d) To stimulate and lead public discussion for resolving issues related to the development of the industry.

To achieve its objectives the Faculty will be constantly in contact with the fishing industry through its vocational programmes during and between semesters. It will have constant dialogues with the Government machinery through the Fisheries Division of the Ministry of Agriculture, MAJUJUKAN, MARDI, the private sector and other institutions of higher learning both inside and outside the country. It will also acquaint itself with the problems of the fishermen and fish farmers through its pragmatic extension programmes.

Organizational Structure

Presently there are two departments in the faculty viz.

Department of Fisheries Biology and Aquaculture
Department of Fishing Technology and Marine Science.

Each department is headed by a head of Department.

The two departments set-up is an interim measure to manage the daily activities of the faculty and plan for its future development.

On attainment of full physical and manpower development the faculty will split into four departments, each dealing with a specific discipline in the field of Fisheries and Marine Science. The four departments are:

Department of Fisheries Biology
Department of Aquaculture
Department of Fishing Science and Technology
Department of Marine Science

A Marine Science Station was established at Kuala Trengganu in 1979 to provide physical facilities for practical training and research in the areas of Fishing Science and Technology and Marine Science aspects of the academic programme. The Head of Station has been recognised to possess the same status as the Head of Department. Another field station is in the process of being established in Port Dickson.

Course Curriculum

The focus of the curriculum for the degree of Bachelor of Science (Fisheries) and the Diploma in Fisheries are evolved around the relationships of Man and the Aquatic Organisms. The curriculum gives the student an understanding of the theoretical and applied knowledge of the Aquatic Organisms and their inter-relationship with the environment and how this understanding will serve Man and in its turn how Man will exploit and perpetuate them for his benefit.

Degree Curriculum

The student enrolled for the degree programme would acquire sufficient knowledge to fit into a general, managerial and technical position. He is trained to enable him to:

- a) raise the economic and social status of the fishermen and fish farmers by increasing their output and income.
- b) develop and exploit to the maximum the fisheries resources in accordance with sound fisheries management practices.
- c) carry out investigation or research into problems affecting the resources and techniques.
- d) become instructors in fisheries training and development programmes.

Diploma Curriculum

The Diploma Programme is aimed at producing technically trained sub-professionals who are capable of directly helping the fisherman or fish farmer with his day to day problems. The curriculum is heavily biased towards the applied aspects of inland and marine fisheries.

DIPLOMA IN FISHERIES

FIRST YEAR

Semester I	Code	Course	Credit
	BB	Language	2
	BIO 101	Principles of Biology I	3
	FIZ 101	Introductory Physics I	3
	KIM 110	Physical Chemistry	3
	MAT 101	Mathematics I	3
	FSS 111	Swimming and water Safety	1
	SK 201	Introduction to Sociology	1
	SK 202	Introduction to Psychology	1
		Field Work	1
		Total	18

Semester II

Semester II	Code	Course	Credit
	BIO 102	Principles of Biology II	3
	BB	Language	2
	EKO 111	Basic Economics	2
	AKN 210	Introduction to Accounting	2
	FIZ 102	Introductory Physics II	2
	KIM 120	Organic Chemistry	3
	MAT 102	Mathematics II	3
	FSS 121	Introduction of Malaysian Fisheries	1
	SK 204	Rural Sociology	1
		Total	20

SECOND YEAR

Semester I

Code	Course	Credit
BB	Language	1
PP 203	Development, Execution and Evaluation of Extension Programme	2
PSS 131	Biology of Fishes	4
PSS 132	Biology of Aquatic Invertebrates	3
PSS 133	Aquatic Ecology	3
PSS 134	Applied Aquatic Chemistry	3
PSS 135	Fisheries Law, Management and Conservation	2

Total

18

THIRD YEAR

Semester I

Code	Course	Credit
PSS 151	Fishing Methods I	2
PSS 152	Fishing Methods II	2
PSS 153	Navigation and Seamanship II	3
PSS 154	Applied Limnology and Oceanography	3
PSS 155	Food and Nutrition of Fishes	3
PSS 156	Project Elective and Presentation I	4

Total

17

1961

Semester II

Code	Course	Credit
BB	Language	1
EPT 133	Introduction to Cooperative Management and Administration	3
MKN 100	Fish Processing and Preservation	3
PSS 141	Aquaculture I	3
PSS 142	Fisheries Microbiology	3
PSS 143	Fishing Gear	2
PSS 144	Navigation and Seamanship I	4

Total

19

Semester II

Code	Course	Credit
EPT 132	Fisheries Marketing	2
PSS 161	Aquaculture II	3
PSS 162	Seminar	1
PSS 163	Fish Diseases	3
PSS 164	Hatchery and Nursery Management	3
PSS 165	Project Elective and Presentation II	4

Total

16

BACHELOR OF SCIENCE (FISHERIES)

SECOND YEAR

FIRST YEAR			SECOND YEAR		
Semester I			Semester I		
Code	Course	Credit	Code	Course	Credit
ACRO 200	Introduction to Agriculture	1	BKM 300	Basic Biochemistry	3
BB	Language	2	ESA 454	Fisheries Economics	3
BIO 301	Principles of Biology III	3	PSS 331	Anatomy of Fishes	2
FTZ 206	Applied Physics	3	PSS 332	Vertebrate Systematics	3
XIM 220	Organic Chemistry	3	PSS 333	Aquatic Ecology	3
MAT 301	Concepts in Algebra and Calculus	2	PSS 334	Biology and Systematics of Aquatic Invertebrates	3
SK 201	Introduction to Sociology	1	PSS 335	Psychology	2
SK 202	Introduction to Psychology	1		Total	19
	Total	16			
Semester II			Semester II		
Code	Course	Credit	Code	Course	Credit
KPS 202	Technical Drawing	2	KPS 217	Engineering Technology for Fisheries	3
BB	Language	2	ESA 357	Fisheries Institution	2
BIO 302	Principles of Biology IV	3	PSS 341	Physiology and Behaviour of Fishes	3
EXO 311A	Principles of Economics	2	PSS 342	Principles of Aquaculture	2
KIM 210	Physical and Inorganic Chemistry	3	PSS 343	Introductory Limnology	3
MAT 304	Statistics for Applied Sciences	2	PSS 344	Fish Nutrition	3
PSS 111	Swimming and Water Safety	1	PSS 345	Aquatic Microbiology	3
SK 204	Rural Sociology	1		Total	19
SK 205	Social Psychology	1			
	Total	17			

THIRD YEAR

Semester I

Code	Course	Credit
PSN 310A	Business Organisation and Management	2
MKN 332	Fish Processing and Preservation	3
PSS 351	Seminar	1
PSS 352	Fish Diseases I	3
PSS 353	Nautical Sciences	4
PSS 354	Nursery and Hatchery Technical	3
PSS 355	Breeding and Genetics of Fish	2
Total		18

Semester II

Code	Course	Credit
PSS 361	Introductory Oceanography	3
PSS 362	Principles of Fishing Gear	2
PSS 363	Fish Population Dynamics	2
PSS 364	Fisheries Meteorology	2
PSS 365	Coastal Aquaculture I	3
PSS 461	Fish Taxonomy	2*
PSS 462	Nautical Science II	2*
PSS 463	Fish Resource Management	2*
PSS 464	Biology of Marine Invertebrates	2*
Total		16

* Elective Courses

* Students are required to take at least two electives per semester

FOURTH YEAR

Semester I

Code	Course	Credit
PP 203	Development, Execution and Evaluation of Extension Education	2
PSS 371	Fishing Methods	2
PSS 372	Research Methods and Statistics	2
PSS 373	Fishing Operation	2
PSS 374	Fishing Gear Technology	2
PSS 375	Fishing Port and Vessel Management	2
PSS 376	Fishing Instrument and Electronics	2
PSS 471	Biological Oceanography	2*
PSS 472	Physical Oceanography	2*
PSS 473	Fish Physiology	2*
PSS 474	Deck Machinery	2*
PSS 475	Coastal Aquaculture	2*
Total		18

Semester II

Code	Course	Credit
PSS 381	Freshwater Aquaculture I	3
PSS 382	Project and Seminar	5
PSS 383	Resource Evaluation Management	3
PSS 481	Freshwater Aquaculture II	2*
PSS 482	Limnology	2*
PSS 483	Chemical Oceanography and Marine Pollution	2*
PSS 484	Fish Diseases II	2*
Total		15

SYNOPSIS OF COURSES OFFERED BY THE FACULTY
OF FISHERIES AND MARINE SCIENCE

- PSS 111 Swimming and Water Safety** 1 credit
Theory on Red Cross Simple First Aid, Water Safety and Boat Safety. Practical aspects on the introduction into the various swimming techniques including the front crawl, back stroke and breast stroke; recovering object from 6-8 feet of water; demonstrating basic rescue techniques and use of clothing as floatation aids.
- PSS 121 Introduction to Malaysian Fisheries** 1 credit
History and development of the fisheries industry in Malaysia. Role of fisheries in the national economy and in human nutrition. General survey of Malaysian fisheries resources and distribution according to habitats, species, gear-groups, etc. Status and potentials of aquaculture. Fisheries administration and organisations (government, semi-government and private sectors) in Malaysia, to include their structure, roles and functions.
- PSS 131 Biology of Fishes** 4 credits
Basic anatomy and physiology of fish, to include discussion on diversity in structure, function and habits with emphasis on feeding, growth, reproduction and life-history. Classification and identification of local commercial species.
- PSS 132 Biology of Aquatic Invertebrates** 3 credits
Classification and identification of local commercially important species. Structure, function, habits and life-history of various common invertebrates, especially the commercially important species e.g. prawns, crabs, mussels, cockles, oysters, cuttlefish, squids, corals, etc.
- Use of keys for classifying organisms. Field identification, preservation and transportation of organisms. Studies on the morphology and anatomy of commercially-important invertebrates.
- PSS 133 Aquatic Ecology** 3 credits
Introduction to ecology. Nature of ecosystem, energy flow and biogeochemical cycles. Ecological factors e.g. temperature, light. Organisation and dynamics of some aquatic ecosystems. Some ecological considerations e.g. migration, biological clock, succession, stratification and zonation of biota. Applied ecology-mainly pollution aspects and management of local aquatic systems.
- Laboratory estimation of primary production; analysis and interpretation of data on production of some ecosystems. Classification and identification of algae with emphasis on ecological significance; as a resource and problem to man. A general survey of some aquatic ecosystems, eg. intertidal, coral reefs, coastal, oceanic and freshwater communities.
- PSS 134 Applied Aquatic Chemistry** 3 credits
Basic concepts in analytical chemistry with emphasis on the aquatic system. The chemistry of freshwater and seawater. The fundamental theory and application of titration, solvent extraction, photospectroscopy, atomic absorption spectroscopy, etc. for chemical analysis of water and soil. Laboratory practicals; determination of salinity, alkalinity, turbidity, hardness, oxygen content, pH, phosphate, silicate, nitrate, ammonia, etc. in the water as well as the determination of crude protein, lipids and other chemicals in the fish and fish feed. The care and proper use of pH meter, spectrophotometer, O₂ analyzer, HACH kit, analytical balance, etc.
- PSS 135 Fisheries Law, Management and Conservation** 2 credits
Principles of fish management and conservation introduction, definition, history and early attempts of managements. Objectives and methods of management. Marking as a tool for research and management. Carrying capacity, productivity and growth, plumpness of fish, age and growth, maximum sustainable yield. Population dynamics. Sea management and problems related to Malaysian waters.
- International law of the sea - convention of the high seas, fishing and conservation of living resources of the sea, continental shelf and the territorial and contiguous seas. Application of international law of fisheries. Malaysian Fisheries Act and Regulations.
- PSS 141 Aquaculture I** 3 credits
History and development of aquaculture. Principles of inland and coastal aquaculture. Ranges of aquaculture practices. Biological principles underlying the practices of aquaculture. Desirable characteristics in a cultured organism. The physico-chemical qualities of water and soil for aquaculture. The roles of calcium, magnesium, nitrogen, phosphorus, potassium etc. in the productivity of fish ponds. Selection of pond site. Topography, soil type, water quality and quantity.

Design and construction of ponds. Freshwater and brackish water ponds. Preparation of ponds for stocking. Stocking rates. Monoculture and polyculture. Factors affecting maximum standing crop. Fertilization of ponds. Fertilizers — organic and inorganic. Control of ponds biota. Types of ponds biota and their control — biological, mechanical and chemical. Supplementary feeding and natural food. Importance of artificial feed. Principal food used in fish culture — food of plant and animal origins and dry concentrated food. Maintenance and repair of ponds. Visit to aquaculture centres and commercial fish ponds.

PSS 142 Fisheries Microbiology

3 credits

Fundamental microbiology with emphasis on the aquatic system. The structure of bacteria, actinomycetes, fungi, algae, protozoa and viruses. The important role of microorganisms in the aquatic environment, method of sterilization, cultivation, disinfection, chemotherapy, etc. Application of microbiological techniques in fish preservation and fish pathology. The study of microbial infections on local fishes and their isolation. Laboratory practicals include staining techniques, morphology study, medium preparation and sterilization, enumeration, cultivation and identification of microorganisms in the aquatic environment as well as in fishery products.

PSS 143 Fishing Gear

2 credits

Classification of fishing gears. Classification of fishing gear materials — physical and chemical properties. Twine and rope construction and numbering system. Calculation of taper rates, hanging ratio, theoretical depth, slack coefficient of webbing. Making and reading fishing gear specifications and plans. Net loft work. Care and maintenance of fishing gear — making a webbing, selvages, battings, creasing, flymeshes, mending quarters.

PSS 144 Navigation and Seamanship I

4 credits

Introduction: parts of a ship, shipboard terminology, anchor work. Strength of ropes, wire and chains, blocks and tackles. Deck appliances. Rules of the road, morse code and international code of signal flags. Life saving appliances. Duties of trawler officer on board. Seamanship laboratory includes handling ropes and wires, knots, bends and splices. Bosun's chair and staging. Basic principles of navigation. Coastal navigation, tides, international buoyage system and chart work. Sextant.

PSS 151 Fishing Methods I

2 credits

Principles and operation of traps, fish and crab pots, gill-nets, long lines, hand lines, beach seines. Vessels and deck layouts and ancillary gears. Choice of fishing grounds. Design and construction of these gears. Modern trends in inshore vessels and fishing gears. Net loft work, mending large tears, replacement of panels, scorning, assembly and roping of gill-nets and bottom long lines.

PSS 152 Fishing Methods II

2 credits

Principles and operation of trawling covering side trawling, stern trawling, pair trawling, shrimp trawling and mid-water trawling. Purse seining, seining. Modern trend in fishing vessels — multipurpose vessels and varied net handling arrangements. Fish handling — preserving the quality of the catch from the fishing grounds to the fishing port. Fish detection by echo-sounders, and sonar. Net loft work including roping and assembly of bottom trawls, midwater trawls and making scale model nets.

PSS 153 Navigation and Seamanship II

3 credits

Shiphandling — single screw, twin screw, coming along side, ship emergency procedure. Logbooks, ships displacement terms. Basic engineering knowledge, ship stability, R.T. Morse code and international code. Laboratory work to include wire splicing, maintenance and use of blocks and tackles. Ships chronometer, time. Principles of navigation, compass error by amplitude of the sun, true altitude, latitude by Meridian altitude. Longitude by intercept. Position fix, laboratory work to include navigation aids. Auto direction finders, echo-sounders and radar — operation and limitations.

PSS 154 Applied Limnology and Oceanography

3 credits

General introduction to ocean basins and the origin of oceans including sea-floor spreading and continental drift processes. Formation of marine bottom types (marine sediments, limestone, coral, beachrock, sandbars, etc.) Subsea mineral and fossil fuel resources. Physicochemical properties of seawater and their effects on some marine organisms. Tides. Waves, currents. Upwelling. Fisheries forecasting.

General outline of freshwater lentic and lotic systems. Physical properties of water. Local edaphic influence on freshwater bodies (peat soil, acid-sulphate soils etc.). Local man made systems (paddy-fields, tin mining ponds, reservoirs etc.).

Limnological significance and instrumentation of some physico-chemical factors (thermal, optical, specific conductance, water movements, nutrients, etc.). Biological communities and productivity of freshwater systems and its applied aspects.

Physico-chemical water analysis techniques/procedures; qualitative/quantitative estimation of biotic communities; application of techniques/procedure and qualitative/quantitative estimation to some local aquatic environments.

PSS 155 Food and Nutrition of Fishes

3 credits

Natural foods and feeding, with emphasis on plankton, food chains and trophic relationships. Fate of ingested food - digestion, absorption and utilization. Food conversion efficiency. Basic nutritional requirements in fish. Nutritional disorders. Feed formulation and composition. Processing of pellets, meals, pastes and cakes. Biological and proximate analysis of feeds. Practicals on collection and identification of plankton; analysis of feeding habits of some common fishes, chemical analysis of feeds.

PSS 156 Project Elective and Presentation I

4 credits

Supervised individual projects within the University or supervised on-the-job training in governmental or quasi-government bodies, fisheries industry or fisheries organization. Project proposal, progress reports and final presentation both in written and seminar forms are required.

PSS 161 Aquaculture II

3 credits

Types and methods of freshwater and brackish water culture. Extensive and intensive culture, padi-field culture, cage culture and culture of specific species - carps, gouramis, snake-head, catfish, udang galah, groupers, milkfish, mullets, cockles, oysters, shrimps, frogs, crocodiles, seaweeds. Sewage-fed fisheries. Culture of some important invertebrates for fish food - infusoria, bloodworms, water-fleas. Harvesting, handling and transportation of cultured organisms. Seed production and supply. Techniques in fish breeding - natural and induced spawning.

PSS 162 Seminar

1 credit

Seminars on various fisheries topics by invited guests from the universities, industries, government and research institutions. Students' seminars and/or debates on assigned topics in fisheries.

PSS 163 Fish Diseases

3 credits

Fish diseases caused by organisms and nutritional deficiencies and their differences. Identification of the common fish diseases and collection of samples to be sent for post mortem. Life-cycle of common fish parasites. Prevention and known treatment of certain common fish diseases.

PSS 164 Hatchery and Nursery Techniques

3 credits

Layout of a typical fish hatchery. Setting up of a simple filtration system. Water quality and supply to hatchery and nursery ponds. Types of incubators for hatching eggs. Food-artificial and live food. Stocking and management of fry. Handling and transportation of fish fry. Prevention and treatment of diseases common to fish fry.

PSS 165 Project Elective and Presentation II

4 credits

Supervised individual projects within the University or supervised on-the-job training in governmental, or quasi-government bodies, fisheries industry or fisheries organizations. Project proposal progress reports and final presentation both in written and seminar forms are required.

PSS 212 Fish Culture

2 credits

History and development of aquaculture. The physico-chemical qualities of water and soil for aquaculture. Selection of pond site. Design and construction of ponds. Preparation and stocking of ponds. Application of fertilizers in fish ponds. Feeding and supplementary feed. Stocking rates. Maintenance and repair of ponds. Types of fish culture practices. Harvesting and post harvest handling. Seed production and supply. Fish breeding. Practicals include analysis of soil and water for fish pond. Construction of pond. Analysis of feeds used in fish culture. Visit to fish farms.

PSS 221 Fisheries Science

2 credits

Introduction to Malaysian fisheries - present status and developments. General survey of Malaysian Fishery Resources. Classification of capture fisheries by species. Classification of capture fisheries by habitat-pelagic and demersal fisheries. Analysis of condition of the existing fisheries and its potential. Introduction and classification of fishing gears. Principles and operation of fishing gears. Factors for selection and efficiency of each fishing gear. Cost of operation for each fishing gear unit. Future trends in fishing operations. Fish processing. Fish

preservation. Status and potential of aquaculture in Malaysia. Prerequisites for fish culture. Choice of species, present farmed species, deviation eg. induced spawning. Pond construction, principles of pond management and care. Culture practices of a few presently farmed species. Generalised energy flow in eco-systems. Biogeochemical cycles. Aquatic pollution and ecological principles. First step in conservation and early attempts in management. Definition, objectives and management techniques. Methods of management regulation. Commercial and recreational fisheries management. Sea management and problems in Malaysian waters.

PSS 222 Limnology and Coastal Oceanography

3 credits

General outline of freshwater lentic and lotic systems. Hydrological cycle and water balance. Physico-chemical regime. Local natural systems (peat swamps, etc.) and man-made systems (padi-fields, tin-mining pools, fish ponds, reservoirs, irrigation canals, etc.). Interactions of freshwater organisms with their environment. Productivity of some freshwater bodies. General management of inland water resources (include pollution, conservation, fisheries, multipurpose, resource management).

Introduction to oceanography. Tides and waves. Currents. Atmosphere and ocean. Physico-chemical properties of seawater. Interactions of marine organisms with their environment. Cycle of production in the sea. Estuaries — a special case. Pollution (coastal zone, general effects of pollutants, specific pollutants, microbial aspects, effects on coastal fisheries). Biological basis on marine conservation.

Physico-chemical water analysis, techniques/procedures. Equipment demonstrations. Field trips. Case studies.

PSS 331 Anatomy of Fishes

2 credits

Essential features of the lower types; External anatomy and adaptive radiation in fishes; skin and exoskeleton; Comparative anatomy of endoskeleton in fishes; comparative anatomy of digestive, respiratory, circulatory, urinogenital, nervous system and sense organs in fishes.

PSS 332 Vertebrate Systematics

3 credits

History and development of modern taxonomy; rules of systematics, taxonomy and classification; principles and methods of classification; biological properties of species, morphological characters of species; kinds and species.

Isolating mechanisms and hybridization in fishes; geographic variation and speciation in fishes, ecology of speciation; Taxonomic collections, preservations and process of identification, taxonomic decisions on the species level and procedure of classifying with emphasis on the commercially important food fishes of Malaysia; Zoological nomenclature.

PSS 333 Aquatic Ecology

3 credits

Ecosystem Concept

Basic ecological principles and concepts pertaining to ecosystems, energy-flow, laws of thermodynamics, biological control, homeostasis, food chains/webs; pyramids, trophic structure, etc. Quantitative energy-flow patterns in a few selected examples. Primary production. Consumer production.

Biogeochemical Cycles

Hydrological cycle. Inter-relationships of land-sea-air. Gaseous and sedimentary cycles and their ecological significance. Marine and freshwater cycles.

Limiting Factors

Liebig's/Sheffield's/Combined "Laws". Ecological indicators.

Community and Population Aspects

Ecological Dominance. Species diversity. Patterns in communities. Ecotone/edge effect. Population properties — density, natality, mortality, intrinsic growth rate, age distribution, growth forms, carrying capacity, etc. Types of interactions.

Habitat Studies

Classification of aquatic ecosystems. Terminology. Niche/habitat. Ecological constraints and community structure in freshwater, estuarine marine ecosystems with emphasis on Malaysian habitats — include field surveys.

Ecological Factors

A few selected parameters — light, temperature, moisture.

- phosphorus, carbon, sulphur, silica, iron, calcium, manganese. Biology and productivity of freshwater biota - phytoplankton, zooplankton, macrophytes and benthos. Applied aspects - pollution, conservation and management of inland waters. Field surveys of different fresh-water systems-ponds, reservoir, stream, mining pools, peat-fields. Research paper on current topics in Limnology.
- PSS 344 Fish Nutrition** 3 credits
Investigation of the varieties and abundance of natural foods. Requirements for energy and non-energy foods (proteins, fats, carbohydrates, vitamins and minerals) and their roles and functions. Energy requirements and, the calorific values of fish feeds. Natural and artificial ingredients commonly used in practical diets, and their food values. Formulation of feeds. Fish feed processing and storage. Feed evaluation - proximate analysis, digestibility and analysis of growth response and conversion efficiencies. Nutritional fish diseases and pathology.
- PSS 345 Aquatic Microbiology** 3 credits
Basic principles of microbiology with emphasis on aquatic environment. Ecology, distribution, physiology and metabolic activities of microorganisms - bacteria, fungi, algae and protozoan in the aquatic environments. Geomicrobiological and mineralization activities of the aquatic microorganisms. Marine microbiology. Microbiology of fish and crustacean, other fishery by-products.
- PSS 351 Seminar** 1 credit
Seminar on fisheries institutions and related topics will be given by invited speakers.
- PSS 352 Fish Diseases I** 3 credits
Basic concept of histology, pathology, microbiology and parasitology pertaining to fish diseases. A systemic study of the common freshwater and marine fish diseases - etiology, epidemiology, clinical signs, pathogenesis, laboratory diagnosis, treatment and control.
- PSS 353 Nautical Science I** 4 credits
Shipboard terminology and orientation. Ropes, wires, block, tackles and derrick system. International regulation for preventing collision at sea. Marine communications. Safety at sea and life saving appliances. Division of work aboard ship.
- Fundamental of navigation, charts, chartwork. Buoyage system and pilotage. Tidal theories and calculations. Radio navigation systems.
- PSS 354 Nursery and Hatchery Technique** 3 credits
Layout of a typical fish hatchery. Kinds of filter - biological, mechanical and chemical. Water quality and supply to hatchery and nursery ponds. Methods of hatching eggs. Types of incubator. Food - natural and artificial. Preparation and management of breeding and nursery ponds. Culture of invertebrates for fish food. Handling and transportation of fish seeds and breeders.
- PSS 355 Breeding and Genetics of Fish** 2 credits
Introduction to the principles of quantitative and population genetics. Estimation of heritability and repeatability. Correlated characters. General principles of selection. Systems of breeding. Genetic variability and hybridisation in fish population.
- PSS 361 Introductory Oceanography** 3 credits
Characteristics of ocean; physical properties of ocean - winds, tides and currents; chemical composition and properties of seawater; plankton and benthic communities; marine pollution.
- PSS 362 Principles of Fishing Gear** 2 credits
Classification of fishing gears, fishing gear materials, terminology and numbering system. Physical and chemical properties of materials. Instruments for gear materials testing. Calculation and analysis of fishing plans.
Practicals: Care and Maintenance of gears, testing fishing gear materials.
- PSS 363 Fish Population Dynamics** 2 credits
History of the theory of fish population dynamics. Basic laws of population dynamics. Biological principles of the mathematics of the fish population dynamics. Basic methods and biological principles of forecasting. Trends of changes in population structure. Food supply and food relationship of fish. Fecundity, quality of the sex products, and course of spawning. Growth and sexual maturation. Total and natural mortality. Effects of fishing. Principles of raising the productivity of fish population.

- PSS 364 Fisheries Meteorology** 2 credits
Elements of atmospheric phenomena, atmospheric pressure, temperature, humidity, evaporation, clouds, wind, etc. Fundamental pressure systems, air masses, formation of fronts and associated weather. Weather analysis and forecasting for mariner. Meteorological instruments, weather maps and analysis. Air sea interactions, climatic effects to living marine resources.
- PSS 365 Coastal Aquaculture I** 3 credits
Site selection, design and construction of shore facilities. Various farming techniques (intertidal, sublittoral, seabed, floating cages, etc.). Productivity of brackishwater ponds. Food and feeding habits of brackishwater species. Biology and culture of marine species. Shellfishes, seaseeds, etc.
- PSS 371 Fishing Methods** 2 credits
Principles and operational theory of inshore and offshore fishing gear. Design and construction of gears. Vessels deck arrangement and ancillary gears. Gear comparison and modern trends in methods of operation.
- PSS 372 Research Methods and Statistics** 2 credits
Tabulation and analysis of research data. Hypothesis testing. Basic experimental designs. Techniques of taking samples and conducting surveys. Introduction to computer programming. Techniques of presenting research results in scientific papers.
- PSS 373 Fishing Operations** 2 credits
Shipboard work and applied fishing operations. Fishing operations with inshore and offshore gears.
- PSS 374 Fishing Gear Technology** 2 credits
Hydrodynamics of fishing gears; design of fishing gears; comparison law for the design of fishing gears, limitations of model experimental data. Theory and calculations to suit vessel power requirements to fishing gear. Model net experiments.
- PSS 375 Fishing Port and Vessel Management** 2 credits
Fishing ports and harbours; facilities; flow of operations; management of harbours, traffic systems. Economics and management of fishing vessels. Ergonomics of fishing vessels and systems.
- PSS 376 Fishing Instrumentation and Electronics** 2 credits
Basic electric and electronic systems. Design of simple electrical and electronic components. Printed circuits. Study of principles, operations, installation, maintenance and of limitations of echo sounders, net sounders, sonars and other fish detection equipment. Theory of fish attraction.
- PSS 381 Freshwater Aquaculture I** 3 credits
Soil-types, formation, structure, chemistry and classification. Site selection; layout of a fish farm; design and construction of fish ponds. Fertilizers-organic and inorganic and their application in fish culture. Management of fish ponds; weeds, pests and predators. Cultivated species and their cultural techniques. Food and food habits of cultivated species. Stocking rates and production. Culture of organisms other than fish - frogs, crocodiles, etc. Harvesting and post-harvest technology of cultivated organisms.
- PSS 382 Project and Seminar** 5 credits
Each student will work under the direction of a member of the Faculty or any other approved supervisor. He will select topic which are problem orientated and the results will be presented in thesis form and will be critically examined by approved examiner/examiners. He will also be required to present a seminar on the project.
- PSS 383 Resource Evaluation Management** 3 credits
Part A: Economic Resource Evaluation
1. Marine Resource Use Alternatives
(a) Range of water resource requirement: different requirements of society for water-agriculture, fisheries water supply, urban and industrial need, recreation, etc.
(b) Extent of fisheries activity: artisanal fisheries, offshore fisheries, brackish water fisheries, aquaculture, fisheries potential.
(c) Marine resource use and management legislation - brief review of legislation (national and international) which relates to marine resource use, management and development.
2. Biological Basis for Fisheries Planning
(a) Quantitative component effects on growth factors such as:

- PSS 462 Nautical Science II 2 credits
- Shiphandling, deck equipment, basic hydrography. Basic naval architecture, fishing vessels construction. Ship's stability includes hydrostatic and stability informations.
- Spherical trigonometry and celestial navigation.
- PSS 463 Fishery Resource Management 2 credits
- Fish population analysis — species/stock identification, estimate of fish population, abundance, mortality, growth, recruitment and predicting yields. Modeling — logistic model and its development, analytic models. Management of fish populations and their food supply based on the biology of individual species — stream fisheries, lake and reservoir fisheries, herring fisheries, tuna fishery, whale fishery, molluscan fisheries, crustacean fisheries, etc.
- PSS 464 Biology of Marine Invertebrates 2 credits
- Comparative study of life-history, anatomy and physiology including structural and functional adaptations of selected marine invertebrates. Comprehensive survey of local marine invertebrates, field collection and identification.
- PSS 471 Biological Oceanography 2 credits
- Distribution of plankton and nutrients; autotrophic and heterotrophic processes; feeding processes and food requirements of zooplankton; biological cycle, distribution, taxonomy, habitat, chemical composition and production of benthos; effects of pollution on marine organism.
- PSS 472 Physical Oceanography 2 credits
- Physical properties of sea water. Geographic and hydrodynamic aspects of oceanography. The geography of ocean basins. Observed distributions of temperature, salinity, currents and water masses. The hydrodynamic equations. Ocean currents, wind driven currents and thermohaline circulation. Wave motion and tides of the oceans. The turbulent diffusion and mixing of water masses. Heat budget of the oceans. The estuarine and coastal oceanography.
- PSS 473 Fish Physiology 2 credits
- Selected topics in fish physiology, with emphasis on the experimental approach. Reproductive and growth endocrinology and their applications in fish physiology, effects of environment on physiology of fish and their adaptations to
1. Genetics
2. Fertility
3. Temperature
4. pH requirement
5. Other management factors—diseases, pests, etc.
- (b) Constraints due to husbandry practices.
- (c) Constraints due to technology eg. fishing gear, boat sizes.
- (d) Quantitative synthesis of (a) and (b) on fish growth — therefore, yield.
3. Economics Basis for Fisheries Planning
- (a) Concept of a resource — with application to marine resources in Malaysia.
- (b) Economic approaches to resource allocation — the use and choice of criteria.
- (c) Development of decision criteria — especially on B/C, PNW, IRR.
4. Project Evaluation
- Preparation of project paper, synthesizing the elements.
- Part B: Biological Resource Management
- Total populations. Carrying capacity, productivity and growth. Fish production, plumpness of fish, estimation of production. Age and growth. Length-weight relationships. Stocking rates. Yield model in fishery management. Optimum sustainable yield and its application to fisheries. Mathematical formulations of different parameters for fish management. Mangrove swamp management. Sea management and the problem related to local fishery management. Management of inland fisheries.
- PSS 461 Fish Taxonomy 2 credits
- Origin and evolution of fishes, major groups of living fishes; characterisation of living fish groups; methods and procedures of identifying local fishes.

the environment, behavioural aspects — learning and memory, orientation and fish migrations.

PSS 474 Deck Machinery 2 credits

Introduction to hydraulics. Study of hydraulic systems. Design of common hydraulic component. Design and installation of fishing and deck equipments and machinery. Operation and maintenance of deck and fishing machineries.

PSS 475 Coastal Aquaculture II 2 credits

Improvements through artificial selection. Control breeding and seed production. Marine hatchery technique. Potential species. Pests and predators. Problems and their solutions in mariculture. Recent advances in materials and techniques. Project/seminar to be presented.

PSS 481 Freshwater Aquaculture II 2 credits

Introduction to the concept of Aquaculture — Agriculture integrated farming system and a review of their current practices. Fish culture in padi-fields, reservoirs, canals, rivers, mining pools and other public water bodies. Sewage-fed fisheries. Levels and patterns of Aquaculture industry — small scale rural aquaculture and aquaculture as large-scale industry and their related problems. Further practices in induced breeding. Special problems; project and/or seminar.

PSS 482 Limnology 2 credits

Morphometry/morphology. Data processing and interpretation. Pollution studies. Quantitative sampling techniques; biomass estimate; chlorophyll, etc. Bioassay techniques and interpretation. Advanced water analysis techniques/procedures. Water shed studies and information survey from government/private bodies. Community/population studies. Energy-flow. Special project and write-up/seminar.

PSS 483 Chemical Oceanography and Marine Pollution 2 credits

The chemical nature of the ocean. Chemical characteristics of sea water. The chemical processes that occur in the sea water. Air-sea, water-biosphere and water-sediment interface transfer of matter. Salinity, major and minor elements, dissolved and particulate organic carbon in the sea water. The carbonate system of sea water. Marine pollution. The chemistry of pollutants in sea water. Effects of pollutants on marine organisms. Radiation and thermal pollution. Pollution on coral reefs. Coastal pollution control.

13. R/D TSI


THE RECORD OF DISCUSSIONS BETWEEN THE JAPANESE IMPLEMENTATION SURVEY TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF MALAYSIA ON THE JAPANESE TECHNICAL COOPERATION FOR THE PROJECT FOR THE DEVELOPMENT OF THE FACULTY OF FISHERIES AND MARINE SCIENCE, UNIVERSITI PERTANIAN MALAYSIA

The Japanese Implementation Survey Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Dr. KOJI NOZAWA visited Malaysia from August 16 to August 31 for the purpose of working out the details of the technical cooperation program concerning the Project for Development of the Faculty of Fisheries and Marine Science, Universiti Pertanian Malaysia (hereinafter referred to as "UPM").

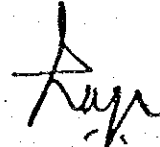
During its stay in Malaysia, the Team exchanged views and had a series of discussions with the Malaysian authorities concerned in respect of the desirable measures to be taken by both Governments for the successful implementation of the above-mentioned project.

As a result of the discussions, both parties agreed to recommend to their respective Governments the matters referred to in the document attached hereto.

August 29, 1984.



Professor Dr. Koji Nozawa
Leader
Implementation Survey Team
Japan International Cooperation
Agency, JAPAN.



Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
MALAYSIA.

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

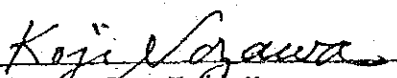
1. The Government of Japan and the Government of Malaysia will cooperate with each other in implementing the Project for the Development of the Faculty of Fisheries and Marine Science, UPM (hereinafter referred to as "the Project") for the purpose of enhancement of the education of the Faculty of Fisheries and Marine Science, UPM and thus contributing to development of human resources in Malaysia.

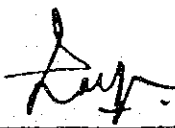
2. The Project will be implemented in accordance with the Master Plan which is given in Annex I.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense services of the Japanese experts as listed in Annex II through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The Japanese experts referred to in 1 above and their families will be granted in Malaysia the privileges, exemptions and benefits in accordance with General Circular No. 1 of 1969 and Amendment


Professor Dr. Koji Nozawa
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Malaysia

to General Circular No. 1 of 1979 of the Government of Malaysia.

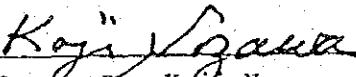
III. PROVISION OF MACHINERY AND EQUIPMENT

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex III through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

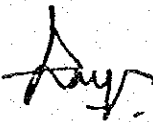
2. The Equipment will become the property of the Government of Malaysia upon being delivered c.i.f. in the Malaysian authorities concerned at the ports and/or airports of disembarkation, and will be utilized exclusively, for the Project in consultation with the Japanese experts referred to in Annex II.

IV. TRAINING OF MALAYSIAN PERSONNEL IN JAPAN

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive at its own expense Malaysian personnel



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Serdang, Selangor
Malaysia.

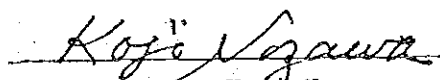
connected with the Project for technical training in Japan through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

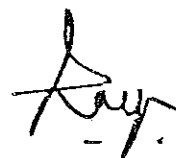
2. The Government of Malaysia will take necessary measures to ensure that the knowledge and experience acquired by the Malaysian personnel from technical training in Japan will be utilized effectively for the implementation of the Project.

V. SERVICES OF MALAYSIAN COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. In accordance with the laws and regulations in force in Malaysia, the Government of Malaysia will take necessary measures to secure at its own expense the necessary services of Malaysian counterpart and administrative personnel as listed in Annex IV.

2. The Government of Malaysia will endeavour to allocate the necessary number of suitably qualified personnel corresponding to each Japanese expert to be dispatched by the Government of Japan as specified in Annex II for the effective and successful transfer of technology under the Project.


Professor Dr. Koji Nozawa
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Implementation Survey Team
Japan International Cooperation
Agency, Japan.


Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia.

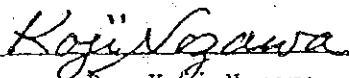
VI. MEASURES TO BE TAKEN BY THE GOVERNMENT OF MALAYSIA

1. In accordance with the laws and regulations in force in Malaysia, the Government of Malaysia will take necessary measures to provide at its own expense:

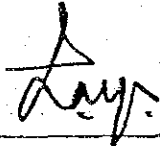
- (1) Land, buildings and facilities as listed in Annex V;
- (2) Supply or replacement of machinery, equipment, instrument, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than those provided through JICA under III above;
- (3) Transportation facilities and travel allowance for the official travel of Japanese experts within Malaysia;
- (4) Housing and other allowances in accordance with General Circular No. 1 of 1979.

2. In accordance with the laws and regulations in force in Malaysia, the Government of Malaysia will take necessary measure-
to meet:

- (1) Expenses necessary for the transportation of the installation, operation and maintenance thereof;



Professor Dr. Koji Nozawa
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Implementation Survey Team
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Agency, Japan.




Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia.

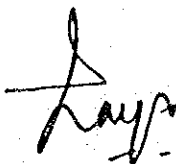
- (2) Customs duties, internal taxes and any other charges, imposed on the Equipment in Malaysia;
- (3) All running expenses necessary for the implementation of the Project.

VII. ADMINISTRATION OF THE PROJECT

1. The Vice-chancellor, UPM, will bear overall responsibility for the implementation of the Project.
2. The Dean of the Faculty of Fisheries and Marine Science, UPM, as the Head of the Project, will be responsible for the administrative and managerial matters of the Project.
3. The Japanese Chief Adviser will provide necessary recommendation and advice on technical and administrative matters concerning the implementation of the Project to the Head of the Project.
4. The Japanese experts will give necessary technical guidance and advice to the Malaysian counterpart personnel on matters pertaining to the implementation of the Project.
5. For the effective and successful implementation of the Project, a Joint-Committee will be established with the function and composition as referred to in Annex VI.



Professor Dr. Koji Nozawa
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Agency. Japan.



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Malaysia.

VIII. CLAIMS AGAINST JAPANESE EXPERTS

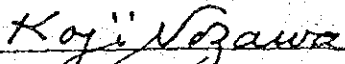
The Government of Malaysia undertakes to bear claims, if any arises, against the Japanese experts engaged in the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in Malaysia except for those arising from the willful misconduct or gross negligence of the Japanese experts.

IX. MUTUAL CONSULTATION

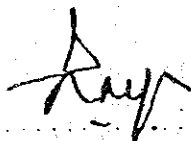
There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

X. TERM OF COOPERATION

The duration of the technical cooperation for the Project under this Attached Document will be five (5) years from October 1, 1984.



Professor Dr. Koji Nowaza
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Agency, Japan.



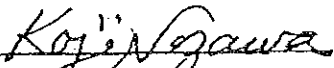
Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia.

ANNEX I MASTER PLAN

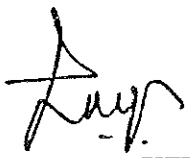
1. The project will be implemented at Faculty of Fisheries & Marine Science UPM, Serdaang and Fisheries and Marine Science Center, Kuala Trengganu.
2. The Objective of the project is to enhance the education of the faculty of Fisheries and Marine Science, UPM, through technical guidance and advice to the teaching staff in the following fields.

- (1) Curriculum developments
- (2) Fishing Gear Technology
- (3) Mariculture
- (4) Fisheries Oceanography
- (5) Navigation and Seamanship
- (6) Population Dynamics
- (7) Hatchery Management
- (8) Fish/Prawn Disease
- (9) Fish Nutrition
- (10) Handling of Caught Fish

Note: Marine Science Station Port Dickson could be added as a project site based upon approval of the Joint Committee.



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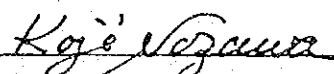
ANNEX II. JAPANESE EXPERTS

1. Chief Adviser

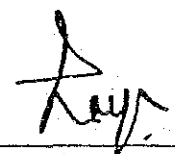
2. Experts in the fields of:
 - (1) Fishing Gear Technology
 - (2) Mariculture
 - (3) Fisheries Oceanography
 - (4) Navigation & Seamanship
 - (5) Population Dynamics
 - (6) Hatchery Management
 - (7) Fish/Prawn Disease
 - (8) Fish Nutrition
 - (9) Handling of Caught Fish

3. Liaison Officer

- Note:
- (1) One of the experts listed in 2 above will be nominated as Chief Adviser by JICA.
 - (2) The experts in the fields mentioned in (6) — (9) above will be dispatched on the short-term basis.
 - (3) Short-term experts in the fields mentioned above and other fields may be dispatched, when necessity arises, for the smooth implementation of the project.



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Malaysia.

ANNEX III. LIST OF EQUIPMENT

1. The Equipment of the following fields:

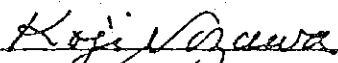
- (1) Fishing Gear Technology
- (2) Mariculture
- (3) Fisheries Oceanography
- (4) Navigation and Seamanship
- (5) Population Dynamics
- (6) Hatchery Management
- (7) Fish/Prawn Disease
- (8) Fish Nutrition
- (9) Handling of Caught Fish

2. Vehicles

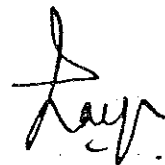
3. Audio-Visual Aids

4. Others

Other necessary equipment, tools and materials to be mutually agreed upon.



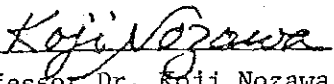
Professor Dr. Koji Nozawa
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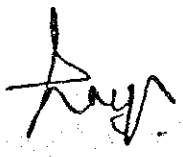


Professor Dr. Nayan Ariffin
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Malaysia.

ANNEX IV. LIST OF MALAYSIAN STAFF

1. Deputy Vice-Chancellor, Academic Affairs, UPM
2. Dean, Faculty of Fisheries and Marine Science, UPM
3. Deputy Dean
4. Head of Departments and Center
5. Teaching staff in the fields of:
 - (1) Fishing Gear Technology
 - (2) Mariculture
 - (3) Fisheries Oceanography
 - (4) Navigation and Seamanship
 - (5) Population Dynamics
 - (6) Hatchery Management
 - (7) Fish/Prawn Disease
 - (8) Fish Nutrition
 - (9) Handling of Caught Fish
6. Captain Chief Officer and Chief Engineer of the training vessel
7. Administrative personnel
 - (1) Clerical and service employees
 - (2) Drivers and labourers

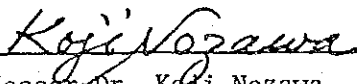

Professor Dr. Koji Nozawa
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Malaysia.

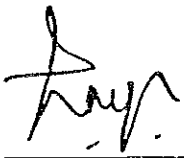
ANNEX V. LIST OF LAND, BUILDINGS AND FACILITIES

1. Land (for UPM, Serdang and Fisheries and Marine Science Center, Kuala Trengganu)
2. Building including the following sectors and other incidental building(s)
 - (1) Administrative sector
 - (2) Auditorium
 - (3) Educational sector
3. Facilities
 - (1) Office(s) for Japanese Chief Adviser, Expert and Liaison Officer
 - (2) Class rooms, practice rooms and workshops
 - (3) Storage for machinery, equipment and materials
 - (4) Parking space
 - (5) Moorage for the training vessel
 - (6) Training vessel and fishing gear

Note: Marine Science Station Port Dickson could be added as a project site based upon approval of the Joint Committee.



Professor Dr. Koji Nozawa
Leader
Implementation Survey Team
Japan International Cooperation
Agency, Japan.



Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor,
Malaysia.

ANNEX VI. THE JOINT COMMITTEE

1. Functions

The Joint Committee will meet at least once a year and whenever necessity arises, and work:

- (1) To formulate the Annual Work Plan of the Project in line with the Tentative Schedule of Implementation formulated under the framework of this Record of Discussions;
- (2) To review the overall progress of the technical cooperation program as well as the achievements of the above-mentioned Annual Work Plan;
- (3) To review and exchange views on major issues arising from or in connection with the technical cooperation program.

2. Composition

Chairman

Deputy Vice-chancellor (Academic Affairs), UPM.

(1) Malaysian Side:

- (a) Dean, Faculty of Fisheries and Marine Science, UPM.
- (b) Deputy Dean, Faculty of Fisheries and Marine Science, UPM
- (c) Head, Department of Fisheries Biology and Aquaculture, UPM
- (d) Head, Department of Fishing Technology and Marine Science, UPM
- (e) Head, Fisheries and Marine Science Center, Kuala Trengganu
- (f) Representative of Ministry of Education
- (g) Representative of Economic Planning Unit

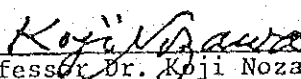
(2) Japanese Side:

- (a) Chief Adviser
- (b) Expert(s) designated by Chief Adviser
- (c) Liaison Officer
- (d) Representative of JICA

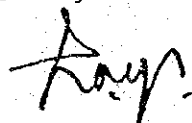
(3) Secretariat:

Shall be provided by the Faculty of Fisheries and Marine Science, UPM.

- Note: 1. Officials of the Embassy of Japan and Faculty staffs designated by the Chairman may attend the Joint Committee as observers.
2. The Chairman can co-opt any other person from among the members of the Malaysian side to sit at any committee meeting.



Professor Dr. Koji Nozawa
Leader
Implementation Survey Team
Japan International Cooperation
Agency, Japan.




Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia.

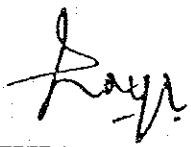
TENTATIVE SCHEDULE OF IMPLEMENTATION
ON
THE JAPANESE TECHNICAL COOPERATION PROJECT
FOR
THE DEVELOPMENT OF THE FACULTY OF FISHERIES AND MARINE SCIENCE,
UNIVERSITI PERTANIAN MALAYSIA
IN
MALAYSIA

The Japanese Implementation Survey Team (hereinafter referred to as "the Team"), organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Dr. Koji NOZAWA, visited Malaysia from August 16 to 31, 1984, for the purpose of formulating, jointly with Malaysian authorities concerned, the Tentative Schedule of Implementation (October 1984 - September 1989) concerning the Japanese Technical Cooperation Project for the Development of the Faculty of Fisheries and Marine Science, Universiti Pertanian Malaysia (hereinafter referred to as "the Project").

As a result of the discussions, both sides have formulated the Tentative Schedule of Implementation as annexed hereto. This has been formulated in connection with the Attached Documents of the Record of Discussions of the Project signed on August 29, 1984, between JICA and Malaysian authorities concerned, on condition that the necessary budget will be allocated for the implementation of the Project and the Schedule is subject to change within the framework of the Record of Discussions when necessity arises in course of the implementation of the Project.



Professor Dr. Koji Nozawa
Leader
Implementation Survey Team
Japan International Cooperation
Agency, Japan.



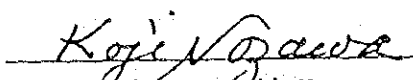
Professor Dr. Nayan Ariffin
Vice-chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia.

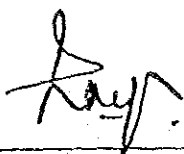
I. Project activities

- (1) Technical guidance and advice to the teaching staffs through curriculum developments and practical training in the following fields.

Categories	1983	1984	1985	1986	1987	1988	1989
(1) Fishing Gear Technology		←			→		
(2) Mariculture				←			→
(3) Fisheries Oceanography		←			→		
(4) Navigation & Seamanship		←		→			
(5) Population Dynamics				←			→
(6) Hatchery Management		←					→
(7) Fish/Prawn Disease		←					→
(8) Fish Nutrition		←					→
(9) Handling of Caught Fish		←					→

- (2) Seminars in the above-mentioned fields (Timing and venue will be determined later).


 Professor Dr. Koji Nozawa
 Leader
 Implementation Survey Team
 Japan International Cooperation
 Agency
 Japan.


 Professor Dr. Nayan Ariffin
 Vice-Chancellor
 Universiti Pertanian Malaysia
 Serdang, Selangor
 Malaysia.

Categories	1984	1985	1986	1987	1988	1989
II. Japanese Contribution						
II-1 Dispatch of Experts						
(1) Long term experts						
- Fishing Gear Technology				→		
- Mariculture			←			→
- Fisheries Oceanography				→		
- Navigation & Seamanship				→		
- Population Dynamics			←			→
- Liaison Officer						→
(2) Short term experts						→
II-2 Dispatch of Teams						
(1) Technical Guidance Team				—	—	
(2) Consulting Team			—			
(3) Evaluation Team						—
II-3 Training of Counterparts in Japan	—	—	—	—	—	
II-4 Provision of Machinery and Equipment		—	—	—	—	—

Note: (1) One of the experts will be nominated as Chief Adviser by JICA.
(2) Short-term experts in the fields mentioned above and other fields may be dispatched, when necessity arises, for the smooth implementation of the project.

Koji Nozawa
Professor Dr. Koji Nozawa
Leader
Implementation Survey Team
Japan International Cooperation
Agency
Japan.

Nayan Ariffin
Professor Dr. Nayan Ariffin
Vice-Chancellor
Universiti Pertanian Malaysia
Serdang, Selangor
Malaysia.

Categories	1984	1985	1986	1987	1988	1989
III Malaysian Contribution						
III-1 Counterparts in the following fields						
(1) For Long term experts						
- Fishing Gear Technology						
- Mariculture						
- Fisheries						
- Oceanography						
- Navigation & Seamanship						
- Population Dynamics						
(2) For Short term experts						
- Hatchery Management						
- Fish/Prawn Disease						
- Fish Nutrition						
- Handling of Caught Fish						
III-2 Administrative personnel						
III-3 Land and Buildings						
III-4 Expenses for implementation of the Project						

Koji Nozawa
 Professor Dr. Koji Nozawa
 Leader
 Implementation Survey Team
 Japan International Cooperation
 Agency.
 Japan.

Nayan Ariffin
 Professor Dr. Nayan Ariffin
 Vice-chancellor
 Universiti Pertanian Malaysia
 Serdang, Selangor
 Malaysia.

1 4. 第 1 回合同委員会議事録

MINUTES OF THE JOINT COMMITTEE MEETING FOR THE
JAPANESE TECHNICAL COOPERATION PROJECT FOR THE
DEVELOPMENT OF THE FACULTY OF FISHERIES AND
MARINE SCIENCE, UNIVERSITI PERTANIAN MALAYSIA

Date : 14th December, 1984

Time : 9:30 a.m.

Venue : Meeting Room,
Faculty of Fisheries and Marine Science,
Universiti Pertanian Malaysia,
Serdang, Selangor.

Present : Professor Dr. Syed Jalaluddin bin Syed
Salim. -Chairman (UPM)
Mr. Makoto Nakamura. (JICA)
Mr. Mitsuo Iwasa. (JICA)
Mrs. Wong Peng Har. (EPU)
Encik Salimi. (Ministry of Education)
Dr. Gunzo Kawamura. (JICA Expert / Chief
Adviser)
Dr. Toshihiro Ichikawa (JICA Expert)
Capt. Tateo Kawakami (JICA Expert)
Mr. Kazuo Udagawa (JICA Liaison Officer)
Encik Mohd. Azmi Ambak (UPM) - Dean
Encik Ridzwan Abudul Rahman (UPM)
Encik Sharr Azni Harmin (UPM)
Dr. Noor Azahar Mohd. Shazili (UPM)
Tuan Haji Umar Salleh (UPM)
Capt. Mohd. Ibrahim Haji Mohamed (UPM)
Dr. Ang Kok Jee (UPM)

1. INTRODUCTION : The Chairman welcomed the members of the
Committee, followed by brief introductory
addresses by Associate Professor Dr. Gunzo
Kawamura, JICA Expert and Chief Adviser,
and the Dean of Faculty of Fisheries and
Marine Science, Universiti Pertanian
Malaysia.

2. MATTERS ARISING

2-1. 1984/1985 WORK PLAN

(a) Dispatch of Experts

The Annual Work Plan on Experts and their Local Counterparts (ANNEX A) was discussed and accepted by the meeting and will be adopted for 1984/85 fiscal year.

To ensure smooth implementation of the plan, the A1 form will be prepared well in advance.

The meeting was informed that the local counterparts listed in ANNEX A were academic staff who were present at the Faculty.

The technicians, although not listed in the list are also regarded as counterparts to the experts.

(b) Training of Local Counterparts

The Annual Work Plan on training of local counterparts in Japan for fiscal 1985 (ANNEX B) was presented and accepted by the meeting. The A23 form should be prepared immediately.

The following matters were also noted in the meeting.

(i) The proposals for the training of local counterparts in Japan are subjected to approval by the Japanese institutions.

(ii) The maximum training period is 11 (eleven) months.

(iii) Presently, one academic staff (Mrs. Siti Shapor) and two technicians (Mr. Muhammad Bin Embong and Mr. Azmi Bin Yaacob) were sent to Japan in November 1984 to undergo short term training in Electrophoresis Techniques, Fisheries Oceanography, and Aquarium Management respectively. However, Mrs. Siti Shapor has returned to Malaysia in December 1984 due to medical reason. The other two are due to return at the end of March 1985.

(c) Equipment Acquisition

The Annual Work Plan 1984/1985 for the equipment (ANNEX C) was presented and accepted by the meeting. The meeting was informed that 50 (fifty) million yen had been allocated for the equipment for fiscal 1984. Out of this, 48 (forty-eight) million yen is for purchasing of equipment in Japan, while the remaining 2 (two) million yen worth of equipment will be bought in Malaysia.

The meeting was also informed that the equipment being purchased in Japan for fiscal 1984 will arrive in Malaysia

between March and May 1985. Besides these equipment, the JICA experts have also brought 2 (two) million yen worth of equipment with them, including micro-computer and books to the Faculty.

The list of equipment for the fiscal 1985 will be prepared jointly by the JICA experts and the Faculty. Efforts will be made to purchase equipment in Malaysia in order to speed up the process.

(d) Joint Academic Activities of JICA/FPSS

The joint academic activities proposed by the Faculty, as listed in ANNEX D, were discussed. The meeting was informed that these activities were suggested by the trust area groups of the Faculty and more activities might be introduced in the near future as experts and their counterparts began to work in their respective areas. It was also pointed out that some of the activities were long term research which could be carried out over the duration of the JICA-FPSS program.

On the subject of preparation of the teaching aids, the chief adviser mentioned that it includes ; acquisition, preparation, and translation of textbooks; preparation of visual aids such as OHP transparency, video and movies; preparation and acquisition of samples of fishing gear as well as navigation equipments, model nets, and etc.

2-2. Financial Situation for Fiscal 1984/1985

(a) UPM

UPM will bear the transportation, installation, and maintenance of the equipments involved in the project. Approximately 10 % of the price of the equipment is secured for that purpose.

Funds for the joint research program is being requested through the University Research Committee, and also from private sectors.

(b) JICA

Since Japan exercise single year budget system, it is not yet known how much equipment will be acquired in fiscal year 1985. Request form of the equipment for fiscal year 1985 should be submitted by March 1985.

2-3. Other Matters

(a) Consultation Mission

The meeting was informed that a consultation mission from JICA would be sent at the beginning of the new fiscal year to finalize JICA's involvement for the year.

(b) Evaluation Team

During the project, an evaluation team from JICA will come to evaluate the implementation of the project.

(c) Master Chart

It was agreed that a master chart be set up to indicate the activities and progress of the project.

The Chairman concluded the meeting by thanking the members for attending the meeting and on behalf of the University he expressed sincere appreciations to JICA for making the project possible.

Equipments

	1984	1985	1986
	12 1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4
Equipment 1984	→ A4		
Purchase in Japan		← Arrival	
Purchase in Malaysia	→ Estimation	→ Purchase & Installation	
Equipments carried by experts.	→		
Equipment 1985	→ A4	Approval by JICA	
Purchase in Japan		← Arrival, Receive and Installation	
Purchase in Malaysia	→ Estimation	→ Purchase	
Equipment carried by experts.			
Equipment 1986			→ A4

Annex B

ANNUAL WORK PLAN 1985
Training of Counterparts in Japan

Fields	Name of Counterpart	1984					1985					1986							
		12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
Larval Rearing & Hatching	Mr. Cheah Sin Hock																		
Fisheries Oceanography	Mr. Liew Hock Chark																		
Fishery Technology	Mr. Khalid Samo																		
Hatchery Management	Mr. Ahmad Kimon Suleiman																		
Counterparts (1986)																			

← A2, A3 →
Counterparts' training plan should be submitted to JICA Kuala Lumpur

Experts and Their Local Counterparts

Fields	Name of Experts and Their Counterparts	1984		1985												1986		
		11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
<u>Long Term</u> Fishing Gear Technology	Dr. Gunzo Kawamura Capt. Mohd. Ibrahim Hj. Mohamed En. Zainal Ashirin Shahardin En. Mohd. Maidin Hamid En. Tajui Aris Yang	from 17/11																upto 14/11
Fisheries Oceanography	Dr. Toshihiro Ichikawa En. Ridzwan Abdul Rahman Dr. Law Ah Theem En. Liew Hock Chark En. Lokman Husin	from 17/11																upto 14/11
Navigation & Seamanship	Capt. Tateo Kawakami En. Khalid Samo En. Abdul Rahim Ibrahim	from 17/11																upto 14/11
Liaison Officer	Mr. Kazuo Udagawa	from 8/12																upto 5/12
<u>Short Term</u> Hatchery Management	Dr. Hachiro Hirata Dr. Ang Kok Jee Dr. Chan Hooi Har Dr. A.K.M. Mohsin En. Shari Azni Harmin En. Siti Shapor Hj. Siraj En. Aizam Zainal Abidin En. Cheah Sin Hock Tuan Haji Umar Salleh Abdullah	A1 26/12																A1 B1 Agreement 1/6 31/8
Navigation & Seamanship	Dr. Kazuo Taguchi En. Khalid Samo En. Abdul Rahim Ibrahim																	A1 B1 Agreement 1/7 31/8

JOINT ACADEMIC ACTIVITIES OF JICA/FPSS

1. Supervision of academic/graduate students program.
2. Seminars and Workshops.
3. Contribution to extension service program.
4. Preparation of teaching aids.
5. Participation in proposed JICA/FPSS research activities.
 - a) Fishery Oceanography & Population Dynamics
 - i) Resource survey in Malaysian Water Management and conservation of resources.
 - ii) Squid fishery.
 - iii) Turtle.
 - iv) Marine process (biological, chemical, physical)
 - b) Fishing Gear Technology.
 - i) Development of energy efficient fishing gear.
 - ii) Fish aggregation devices.
 - iii) Development of more selective fishing gear.
 - c) Seamanship and Navigation
 - i) Mapping and charting
 - ii) Discription of traditional technique.
 - d) Nursery and Hatchery Management.
 - i) Planning and development of the pond and hatchery complex in Kuala Trengganu and Serdang.

14. プロジェクト協力実績

(1) 調査団派遣

1) 事前調査団

氏名	担当業務	期間	派遣時現職
柿本 大竜	団 長	83. 8.13~8.28	鹿児島大学水産学部長
尾上 義夫	海 洋 学	"	鹿児島大学水産学部助教授
川村 軍蔵	漁 法	"	"
西村 俊道	協力企画	"	文部省学術国際局企画連絡課
橋浦 広志	業務調整	"	国際協力事業団林業水産開発協力部 水産業技術協力室室長代理

2) 実施協議調査団

氏名	担当業務	期間	派遣時現職
野澤 洽治	総 括	84. 8.16~84. 8.31	鹿児島大学水産学部長
柿本 大竜	水 産 学	"	鹿児島大学名誉教授
千田 哲資	水 産 学	"	長崎大学水産学部教授
北村 幸久	協力企画	"	文部省学術国際局国際企画課
高橋 満之	業務調整	"	国際協力事業団水産技術協力室

(2) 専門家派遣

氏名	担当業務	期間	派遣時現職
川村 軍蔵	長期調査	84. 4.21~6.20	鹿児島大学水産学部助教授
川村 軍蔵	チーム・リーダー (漁法)	84.11.16~86.11.15	"
市川 敏弘	海洋生物学	"	"
河上 夫	航 海 学	"	"
宇田川和夫	業務調整	84.12. 7~87.12. 6	"
平田 八郎	ふ化場管理	84.12.28~85. 1.22	鹿児島大学水産学部教授
平田 八郎	"	85. 5.27~85. 6.10	"
田口 一夫	航 海 学	85. 8. 6~85. 9. 2	"

(3) 研修員受入

氏 名	担当分野	期 間	主な研修先
SITI SHAPOR HJ. SIRAJ	電 気 泳 動	84.11. 5~85. 3.30	
AZMI BIN YAACOB	養魚池管理	84.11.15~85. 3.30	江の島水族館
MUHAMMAD BIN EMBON	水産海洋学	84.11.15~85. 3.30	鹿児島大学
LIEW HOCK CHARK	海洋水産学	85. 4.28~85.12. 3	東京大学海洋研究所
CHEAH SIN HOCK	種 苗 生 産	85. 4.28~86. 3.30	東京大学農学部
KHALID BIN SAMO	漁 業	85. 4.28~85.12. 3	北海道大学水産学部
SHAMSUL BAHAR BIN AHMAD	ふ化場管理	85. 8.15~86. 5.13	芙蓉海洋開発㈱

(4) 機材供与

番号	品名及び仕様	メーカー名	数量
1	増, 養殖		
1	種苗用水槽		
	(A)ポリカーボネート円形SPS-2000 20001	田中三次郎商店	3台
	(B) " 円形SPS-1000 10001	"	3台
	(C) " 円形SPS-500 5001	"	3台
	(D)アクリル水槽角形900×450×450 1001	"	3台
6	流水殺菌装置ユーゾン 110MR	セン特殊光源	1式
	240V 50HZ 単相		
	交換用ランプ SUV-110(F)	"	2本
12	種苗育種用水槽セット		
	(A)ポリエチレン水槽円形 1001 白色	田中三次郎商店	60台
	(B)キャンパス水槽円形E-20B 25001	"	10台
	(C) " 角形K-3 37001	"	2台
	(D)遮光ネット65%遮光 ダイオ10号 2m巾×50m	"	1巻
	(E)1. ポリエチレン網 200目 121cm×50m	"	1反
	2. " 150目 "	"	1反
	3. " 100目 "	"	1反
	4. " 50目 "	"	2反
	5. " 18目 "	"	2反
	(F)活魚輸送タンク丸形 10001	"	2台
	(G)マグネットポンプMD-30R 321/min 45W	"	3台
	(H)直流ポンプ101/min バス用スぺアポンプ	"	10台
	(I)紫外線流水殺菌装置	セン特殊光源	1台
	サニトロンSS 10G ランプ2本付		
	(J)酸素分散器 180mm	田中三次郎商店	7本
	(K)太陽電池 NT-111 43W DC-12V	"	4台
	(L)過充電防止装置	"	2台
	(M)自動制御盤(特注)	協海洋産業研究所	1式
	機材代合計		
	輸出梱包費		1式
	総 合 計		

番号	品名及び仕様	メーカー名	数量
1	いすゞ4WDワゴン車	いすゞ	1台
	モデル：N-WFS53DVGDA型		
	73馬力ディーゼル・エンジン		
	エアコン, スペアタイヤ1本		
	標準工具一式付		
2	スペアパーツ	いすゞ	1台
	(別紙の通り)		
	(増養殖)		
1	海水用水中ポンプ 100ES 67.5	荏原製作所	1台
	" 50DVF 6.675	"	1台
2	カートリッジフィルター	東洋濾紙	3本
	1本用アクリル製プラスチックハウジング		
	常用圧力 3kg/cm ²		
	接続口径 3/4PT		
	ワインドカートリッジ TCW-1		5ケ
	TCW-3		5ケ
	TCW-10		5ケ
3	マイクロメーター		10ケ
4	冷凍庫 SEU-17 485ℓ	荏原製作所	1台
5	ポータブルコンプレッサー TF DC12V	アース商会	2台
6	システム実体顕微鏡 SMZ 10-3	ニコン	3台
7	ブレンダー 7012S トランス付	ゾニー	1台
8	卵器 MIR251	サンヨー	2台
	明暗タイマー付 内容量254ℓ		
9	海水用電気水温計 ET-5	東邦電探	2台
	直読式 携帯型		
	測定範囲 -5℃~-40℃		
	最小目盛 0.1℃		
	(海洋資源 実験室共用)		
1	採水器		
	バンドーン採水器 附属品付 6ℓ	本地郷	3台
	" 20ℓ	離合社	2台
	ナンセン顛倒採水器 1,300ml	"	5台

番号	品名及び仕様	メーカー名	数量
	附属品 顛倒温度計 2036A	本 地 郷	8 本
	" 2036B	"	8 本
2	塩分測定器 601MKIV	渡 辺 計 器	1 台
	測定範囲 0~51% OS		
	感度 0.04% OS		
	精度±0.003%OS		
	所要水量 55cc		
3	採 泥 器 Bタイプ	離 合 社	1 台
	エクマンバージ採泥器		
4	バシサーモグラフ 2045A	離 合 社	2 台
	深さ範囲 0~60m		
	温度範囲 -1~30℃ 附属品付		
5	温度計用ルーベ №2041	離 合 社	10台
6	水中コミュニケーション装置	日 本 ア ク ア	2セット
7	水中ストロボ ニコノスSB-101	ニ コ ノ ス	2 台
8	照 度 計 IM-2D	ト プ コ ン	2 台
9	(1) 交流定電圧装置 (1KVA)	メ ト ロ ニ ク ス	2 台
	メトロニクス ACV2-1PZSI		
	(2) 万能交流安定化電源 FLA-1000	"	1 台
10	マグネチックスターラMS-TH№140600	日 機 貿	4 台
	ホットプレート付		
11	(1) 電気蒸留装置 5t/h MA-0	島 津 理 化	2 台
	(2) " ES-111-100	"	2 台
12	ブローヤ日立ベニコン200W トランス付RC-2OS	日 立	1 台
	日立オイルフルーベピコン # 0.75kW	"	1 台
13	デジタル塩分測定装置 SA-10-KB	東 亜 電 波	2 台
14	溶存酸素計 ポータブルタイプ CU-12	セ ン ト ラ ル 科 学	3 台
15	デジタルPH/ORP計 UC-23	セ ン ト ラ ル 科 学	3 台
	UC-303E-5		
16	電気伝導度計 UC-33	"	3 台
	(船舶 漁具 漁法)		
1	衛生航法装置 SAN185	光 電	1セット
	二周波測定式		

番号	品名及び仕様	メーカー名	数量
	電源 10~28VDC		
2	トランシット GT-60	測 機 舎	3セット
	正像16倍 視界1° 20'		
	有効径21% 分解力5"		
	付属品として三脚付		
3	三杆分度儀 Ⅱ1724	玉 屋	2台
4	トランシーバー RJ-450	ナ シ ョ ナ ル	5セット
	受信出力500mタイプ		
	8チャンネル 防雨タイプ		
5	航法専用ポケットコンピューター	玉 屋	2台
	PC1253H		
	太陽天測 恒星天測		
	到着緯径度真針路航程		
	大圏航法 他		
	太陽天測 潮流航法 NC-88	玉 屋	1台
	" NC-77	"	1台
6	オシロスコープ 20MHz SS5702	岩 通	1台
	1mv/div 2チャンネル高感度		
7	デジタルマルチメーター SC-7404	"	1台
	直流交流電圧・抵抗直流交流電流		
8	回路計 TEW2412	YEW	2台
	(事務用品)		
1	タイプライター		
	ブラザー ELECTRA-60 トランス付	ブ ラ ザ ー	2台
	コンピュータインターフェイス IS-50A	"	1台
	ディジーホイール	"	12ヶ
	リボン	"	10ヶ
	接続ケーブル		1本
	合 計 金 額		



JICA