FISHERY GROUP

INTRODUCTION

Fishery activities have been an important means of livelihood, traditionally in the coastal areas and more recently in the rural, lacustrine districts of Vidarbha and Marathwada. In the last 15 years fishery activity has developed into a profitable and extensive enterprise. This enterprise consists mainly of three activities : Fish production, Fish processing and Fish marketing. Area-wise, the enterprise is divisible in two categories : Sea-water fishery and fresh-water fishery. The present document is a proposal for two Vocational Courses in fisheries, one for the coastal area (Course-I - Fish processing technology) and the other for the inland area (Course-II - Fresh-water fish culture).

These courses are prepared with a view to impart mainly the practical knowledge with sufficient theoretical background of a subject which can assist the student to seek his livelihood. While there are several activities of fishery enterprise it was deemed practical by the syllabus committee to prepare courses within the means of a higher-secondary school or a junior college. The result is the above mentioned two courses. These courses consist of a "classroom-laboratory-field trip" pattern and can be undertaken by any suitably equipped higher secondary school or junior college in either coastal areas (Course-I) or inland areas (Course-II), where there exists a scope for the student to develop his knowledge into a profitable means of livelihood.

Course I

FISH PROCESSING TECHNOLOGY

Standard XI

PAPER I

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) Introduction to fishery science

Introduction to the broad outlines of fishery activities such as fish catching, fish processing and marketing. Role of processing technology in fishery development.

(2) **Commercially important species of marine fish and shell fish**

Knowledge of commercially important fish and shell fish and their production. Utilization of fish in India.

(3) **Fish as food**

Role of fish in the balanced diet. Importance of fish protein in eradication or protein malnutrition. Comparison of nutritive value and price of fish with that of meat, egg and milk.

(4) **Proximate composition of fish**

Groos biochemical study of the constituent : like proteins, fat, carbohydrates, minerals, vitamins and moisture. Classification of fishes into various categories based on protein and oil content.

(5) **Fish spoilage**

Reasons for fish spoilage : surplus production and under utilization. Mechanism of spoilage : autolysis and bacterial action. Rigor mortis and its significance.

(6) **Fresh fish handling and preservation**

Handling of fresh fish on board and on shore. Importance of hygiene. Use of ice and refrigerated brine to retard post mortem biochemical changes. Use of antibiotics and chemicals.

PRACTICALS

A) **Laboratory work**

1) Identification and study of commercially important and locally available fishes. (Individual student)

2) Identification and study of commercially important and locally available crustaceans and molluscs. (Individual student)

3) Determination of moisture in four different varieties of fish. (Group of 4 students)

4) Determination of crude protein, fat and ash in the dried samples of four varieties of fish (Group of 5 students).

5) Study of organoleptic tests for freshness of fish. Study to be performed on fresh and ice-stored fish.

B) **Field work**

1) Visit to fish market. Study of fish transport and freshness of fish and shell fish.

2) Visit to fish landing centre. Study of fish procurement and its transport.

PAPER II

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) Salting, drying and smoking of fish

Principles of preservation by salting and drying. Indian curing methods. Sun drying with and without salting. Quality of salt for fish curing. Hot and cold smoking of fish. Mechanical dehydration of fish. Types and description of salted, dried and smoked fish products.

(2) Utilization of fish for products

Utilization of lean and fatty fish for fish meal, fish oil, fish flour, fish manure, fish protein concentrate, fish glue and fish silage.

Utilization of specific parts of fish, shellfish and other aquatic invertebrates for specific products such as pearl essence, isinglass, chitosan, leather, etc.

(3) Fish by-products

Manufacture of fish meal, fish manure, fish oil, fish liver oil, fish flour, fish protein concentrate and its use. Manufacture of pearl essence, isinglass, chitosan, leather, etc.

(4) Utilization of sea-weeds

Species of sea-weeds of economic importance. Methods of this harvest. Utilization of sea-weeds for commercial products, like manure-ash, iodine, alginate and agar-agar. Use of sea-weeds in human diet.

(5) Preparation of ornamental articles

Utilization of exoskeleton of crustaceans and shells of molluscs for ornamental articles. Possibility of a small cottage industry.

PRACTICALS

A) **Laboratory work**

1) Preparation of a dried and a salted fish product and its storage. (Group of 4 students)

2) Extraction of fish oil from a fatty fish. Estimation of yield. (Group of 4 students)

3) Preparation of fish-flour from a lean fish. Estimation of yield (Group of 4 students)

4) Preparation of an ornamental article from molluscan shells (Individual student)

B) **Field work**

1) Visit to a fish curing centre. Study of different methods of fish preservation and storage.

Standard XII

PAPER I

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) **Microbiology**

General recount (in brief) of harmful micro-organism in sea-food industry. Brief description of the bacteriological tests employed in sea-food inspection.

(2) **Fish canning**

Principle of canning. General description of the process. Type of biological raw material used and its pre-treatment. Details of the double sealing technique. Changes in canned food, spoilage problem. Indian and international standards for canned food.

(3) **Fish freezing**

Principle of freezing. General description of the process. Type of biological raw material used and its pre-treatment. Changes during frozen storage. Shell life and spoilage problem. Indian and international standards for various types of frozen products.

(4) Quality control, commodity standards and inspection of fishery products

Quality and freshness tests for fish. International standards for quality, commodity and containers for fish products. Inspection of fish products for export trade.

(5) Ice factories and cold storages

General lay-out and operation of an ice-factory. Requirement and regulation of water quality used for ice manufacturing. Utility value of complexing ice-factory and cold-storage. Method of heat insulation. Different types of insulators.

PRACTICAL

A) Laboratory work

1) Sterilization of glass-ware for bacteriological work. (Group of 4 students)

2) Preparation of basic bacteriological media. (Group of 4 students)

3) Determination of bacterial plate counts from fish samples. (Individual student)

4) Study of morphology of bacteria under microscope and gram-staining technique. (Individual student)

5) Identification and grading of different varieties of locally available prawns. (Individual student)

6) Beheading, peeling and deveining of prawns. Estimation of yield from the raw material. Study of count-per-pound system. (Group of 4 students)

B) Field work

1) Visit to a fish landing centre, study of raw material and its procurement by various agencies.

2) Visit to a fish canning factory. Study of the canning process and finished goods. Visit to a freezing plant. Study of the various processing methods and storage.

PAPER II

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) Refrigeration

Principle of refrigeration. General mechanism of refrigeration system. Different types of refrigerents. Stationery and mobile system.

(2) Layout of freezing and canning plant complex

Flowsheet of raw material to finished goods in a canning and in a freezing plant. Hygienic and welfare requirements.

(3) Packaging, storing and transport of finished goods

Indian and international standards of packaging and labelling of canned and frozen sea food. Storage problems of salted, dried, smoked, canned and frozen sea-food and their shelf-life. Method of transport.

(4) Marketing and export

Principles of market survey and marketing applicable to sea-food industry. Brief description of the procedure of export of finished goods. Role of co-operative agencies in sea-food marketing and export.

(5) Economics

Principles of cost of production, consumption, utility and demand, Input-output and loss/profit statements. Subsidies and incentives. Loan facilities. Economics of a canning and a freezing plant.

PRACTICAL

Field work

1) Visit to a freezing plant. Study of the refrigeration system.
2) Visit to a freezing plant. Study of the lay-out and operation.
3) Visit to a canning factory. Study of the lay-out and operation.
4) Study of packaging material, specification of design, marking and labelling.
5) Visit to fish market. Study of the trading and retailing operations.
6) Study of economics of various methods of processing of fish.

Reference Books

Subject : Fisheries - Course I - Fish Processing Technology

PAPER : THEORY I - Standard XI

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
1.	i) An introduction of fisheries Nagaraja Rao ii) Indian Fisheries 1947-77 Published by M.P.E. D.A., New Delhi	1 6	42 - 53	Additional information to be collected by the teacher from the overall information regarding fisheries activities.
2.	i) Symposium on living resources of the seas around India-C.M.F.R.I.Publication, Cochin-11. 1973 ii) Fish as food, Vol.2 G. Borgstrom Academic Press, New York	19	637 - 722	Teacher to collect and dissiminate only important high lights of the presently exploited marine fishery resources.
3.	i) Fish in Nutrition ii) Fish as food, Vol.2 G. Borgstrom	7	267 - 352	

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
5.	i) Fish curing and processing De Merindol, A MIR Publishers, Moscow	1	91 - 98	
6.	i) Fish curing and processing De Merindol, A	3	114 - 121	
Practical I	i) Indian standard methods of test for meat and meat products Part I-V IS : 5960 (I to V) - 1970-71 published by Indian standard Institution, Manak Bhavan, 9, Bahadurshah Zaffar Road, New Delhi - 1			

Reference Books

Subject : Fisheries

PAPER : THEORY II

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
1.	i) Marine products of commerce - Tressler, D.K. and Lemon, J.M.- Reinhold Publishing Corporation, New York, Third edition - 1960	17	361 - 374	Only principles to be taught by the teacher
		19	394 - 424	
	ii) Fish curing and processing De Merindol, A	5	198 - 256	
		8	328 - 363	
	iii) Fish processing in Indo-Pacific area - Subba Rao, G.N.	2	5 - 61	
		4	142 - 164	
2 and 3	i) Marine products of commerce - Tressler, D.K. and Lemon, J.M.	22	469 - 492	Only processes and importance to be taught in brief
		23	493 - 524	
		24	524 - 537	
	ii) Encyclopedia of marine resources-Firth, F.E.-Van Nostrand Reinhold Co. New York, 1969	25	538 - 549	
			229 - 232	
			261 - 265	
			265 - 272	
4	i) Use of sea-weeds directly as human food -I.P.F.C. Regional Studies No.2 F.A.O.Rome			To be taught in brief. No book exists on this subject. Teacher to collect specimens and ideas from the commercial product
5.	-	-	-	

Reference Books

Subject : Fish Processing Technology

PAPER : THEORY PAPER I - Standard XII

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
1.	i) Fish as food, Vol.1 G. Borgstrom	14 15		
2.	i) Fish curing and processing De Merindol, A	9	370 - 456	To be taught in brief
	ii) Marine products of commerce - Tressler, D.K. and Lemon, J.M.	20	425 - 458	
3.	i) Marine products of commerce	16	328 - 360	To be taught in brief
	ii) Fish curing and processing De Merindol, A	4	123 - 188	
4.	-	-	-	Information to be collected by the teacher
5.	-	-	-	- do -
1 - 2	i) Marine products of commerce Tressler, D.K. and Lemon, J.M.	15	307 - 327	
	ii) Fish curing and processing De Merindol, A	3	114 - 121	
3 - 5	-	-	-	Teacher to collect information & specific lectures to be given by subject matter specialists in the industry.

In addition to above following books are recommended to be used as general information source-books :

Subject : Fish Processing Technology
PAPER : THEORY PAPER II

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
1.	i) मत्स्यव्यवसाय-इ. ५/६/७ डॉ. मा. र. रानडे प्रकाशक : मत्स्यव्यवसाय संचालनालय, महाराष्ट्र शासन, मुंबई - २			
	i) मत्स्यव्यवसाय प्रशिक्षण केंन्द्र क्रमिक पुस्तक, श्री.श्री.देसाई प्रकाशक : मत्स्यव्यवसाय संचालनालय, महाराष्ट्र शासन, मुंबई - २			
1, 2, 3.	i) Indian standard Methods for plate count of bacteria in foodstuffs - IS : 5402, 1969 Published by Indian Standards Institute, New Delhi			
4.	i) Indian standard Methods for detection and estimation of coliform bacteria in foodstuffs - IS : 5401 : 1969 IS : 5887 (I-V) : 1976			

Course II

FRESHWATER FISH CULTURE

Standard XI

PAPER I

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) Introduction to fishery science

Introduction to the broad outlines of fishery activities such as fish catching, processing and marketing. Role of freshwater fisheries in rural development of the country.

(2) Fishery biology

Study of food, feeding habits, growth rate, breeding, embryonic and larval development of commercially important freshwater fishes.

(3) Commercially important species of freshwater fish

Knowledge of commercially important fishes such as Rohu, Catla, Mrigal, Cyprinus, Silver carp, Grass carp, etc.

(4) Principles of fish breeding

General principles of genetics, reproduction in fishes and hybridization. Hormonal influence on maturity, fecundity and breeding. Hypophysation and influence of environmental factors such as light, temperature, etc. on breeding of fish. Fish hatcheries and handling of eggs and spawn.

(5) Principles of fish culture

History of fish culture in India, General principles of fish culture, its scope and importance. Fish cultural practices in India. Construction and layout of an ideal fish farm. Pond productivity and sewage fed fisheries.

PRACTICAL

1) Visit to a fishing village to study the fishery activities.

2) Study of food and feeding habits of fishes. Collection of eggs and larval stages of fish and their identification.

3) Collection and identification of commercially important species of fish.

4) Location and removal of pituitary gland and its preservation. Preparation and administration of pituitary dose. Handling of fish eggs, spawn and fry.

5) Visit to fish farms to study ideal layout of fish farms. To estimate the productivity of a tank.

PAPER II

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) Principles of fish nutrition and growth

Principles of fish nutrition. Nutritional requirements of fish. Artificial feeds and their composition. Environmental influence on feeding and growth. Fish growth in ponds. Growth rate of cultivable fishes.

(2) Limnology

Introduction to limnolog. Inland water type. Biological and chemical measures of water quality. Concepts of productivity - standing crop, rate of removal and rate of production.

(3) Physiology of Fish reproduction

Reproductive physiology in fishes. Ecological influence on maturation and spawning. Endocrine physiology. Techniques of selective breeding.

(4) Fish seed production

Fish seed requirement and resources in India. Methods of fish seed production such as bundh breeding, induced breeding, etc. Hatching techniques for different fishes and fish seed transportation.

(5) Craft and gear

Knowledge of the types of crafts and gears used in freshwater fish capture, their maintenance and repairs. Fabrication of gear.

PRACTICAL

1) Experience in the preparation of artificial feeds. Fish growth studies in ponds.

2) Collection and analysis of water samples for study of temperature, turbidity, pH, Oxygen, CO_2 alkalinity, hardness, etc.

3) Study of maturation process. Estimation of fecundity.

4) Collection of fish seed from rivers. Handling of fish eggs and spawn on a fish farm. Study of hatching operation.

5) Fabrication of gill net.

Standard XII

PAPER I

Teaching Scheme : (Periods per week)

Theory : 4 periods Practicals : 4 periods

THEORY

(1) Aquatic weeds, fish diseases and predators

Aquatic weeds in fishery waters and their influence on fish production. Weed control. Important fish diseases and predators and their control.

(2) Methods of fish cultivation

Study of various methods of fish cultivation such as pond cultivation, cage and pen culture, raceway culture, fish culture in recirculating water system.

(3) Fish farm management

Management of hatchery, nursery, rearing and stocking ponds. Predators and their eradication. Weed control. Algal blooms and their control. Cultivable species, their stocking rate, survival, growth and production. Manuring fish ponds and artificial feeding.

(4) Farm engineering

Fish farms, their objectives and significance. Fresh water farm location, design and construction. Soil and water conditions. Maintenance of fish farm.

(5) Survey and statistical methods

Survey of fresh water fisheries, methods and techniques employed in survey of fresh water fishery resources. Scope and objectives of fishery statistics.

PRACTICAL

1) Collection and identification of common aquatic weeds. Practical training in their control. Collection and identification of fish parasites, predators, etc.
2) Visit to fish farms to make an on the spot study of various methods of fish cultivation.
3) Collection and identification of spawn, fry and fingerlings of cultivable species. Study of methods of manuring and artificial feeding.
4) Visit to fish farms to study their construction and operation. Designing of different farms.
5) Survey of ponds, Designing a proforma for survey. Visit to market and collection of fish landings.

PAPER II

Teaching Scheme : (Periods per week)
Theory : 4 periods Practicals : 4 periods

THEORY

(1) Marketing and Co-operation

General principles of marketing. Market survey, channels of distribution of fish. Price structure. Co-operative movement in India. Marketing of fish through co-operative societies.

(2) Economics

Introduction to fisheries economics. State and National income from fresh water fisheries. Economics of fish seed production and fish production by various methods of cultivation.

(3) Fresh water fisheries of India

Knowledge of scope and importance of freshwater fisheries in India. Production and utilization of fish.

(4) Aquarium maintenance

Fabrication and setting up of an aquarium tank. Importance of water, weeds, light, temperature, etc. on tropical aquarium fishes. Food for the aquarium fishes.

(5) Breeding of aquarium fish

Knowledge of breeding of various aquarium fishes and their

requirements. Methods of spawning and rearing of aquarium fish. Economic importance of aquarium fishes.

PRACTICAL

1) Study of marketing agencies, visits to fish markets. Visit to a fisheries co-operative society to study its working.
2) Economic study of fish cultivation of different methods.
3) Collection and tabulation of freshwater fish production in India.
4) Fabrication of an aquarium tank and setting it up. Collection of food organisms for aquarium fish.
5) Breeding and rearing of live bearers and other aquarium fish.

Reference Books

Subject : FISHERY COURSE II

FRESH-WATER FISH CULTURE

Standard XI - PAPER I

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
Theory				
1.	i) Fish and fisheries of India By Jhingran V. G. Hindustan Publishing Co., New Delhi 7 (1975)	-	V - VII	Additional information to be collected by the teacher
	ii) An introduction to Fish Culture By Ranade M. R. Marine Biological Research Station, Ratnagiri	-	1 - 2 36 - 38	
2 & 3	i) Fish and fisheries of India By Jhingran V. G.	2 - 5	450 - 523	
	ii) Aquaculture Bardach J.E., Ryther J. H. & McLarney W.O., Willey Inter Science, New York (1972)	2 3 4	29 - 74 75 - 120 121 - 146	
	iii) An introduction to Fish Culture By Ranade M.R.	3 6	4 - 8 11 - 12	
4.	i) Fish and fisheries of India By Jhingran V. G.	2 - 5	501 - 524	Nil

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
	ii) Breeding of the Common Carp I.C.A.R. Publication, Central Inland Fisheries Research Institute, Barrackpore, West Bengal	-	1 - 7	
	iii) Induced Breeding of major carps I.C.A.R. Publication, C.I.F.R.I. Barrackpore, West Bengal	-	1 - 11	
5.	i) Fish and fisheries of India By Jhingran V. G.	2 - 0 2 - 7 2 - 5	85 - 96 778 - 788 441 - 449	
	ii) An Introduction to Inland Fish Culture By Ranade M. R.	13 8	32 - 34 15 - 18	
Practical				
2.	i) Fish and fisheries of India By Jhingran V. G.	-	259 - 240	
4.	ii) Technique of Carp pituitary gland removal and ampouling I.C.A.R. Publication, C.I.F.R.I. Barrackpore, West Bengal	-	1 - 4	

Reference Books

Subject : FRESH-WATER FISH CULTURE

Standard XI - PAPER II

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
Theory				
1.	i) An introduction to Inland Fish Culture By Ranade M. R.	10 - 11	22 - 29	Nil
	ii) Text Book of Fish Culture By Huet M. Fishing News (Books) Ltd., U.K.	13	331 - 335	
2.	i) Fresh Water Fishery Biology By Lagler K. F.	18 - 19	234 - 280	
	ii) Biological Basis of Fresh Water Fish Production By Gerking S. D. Blackwell Scientific Publications, U.K.	-	-	Teacher to collect the information in brief from this book.
3.	i) The Physiology of Fishes By Brown, M.E. Academic Press, New York (1957)	6 - 7	245 - 322	To be taught in brief as broad outlines
4.	i) An Introduction to Water Fish Culture By Ranade M. R.	-	-	General information
	ii) Fish and fisheries of India By Jhingran V. G.	2 - 5	501 - 528 634 - 650	

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
5.	i) Fish catching methods of the world By Von Brandit, A. Fishing News (Books) Ltd. U.K.			Teacher to collect relevant information from this book and to teach in brief.
Practical				
II 2-4	i) Manual of Methods in Fisheries Biology - Levastu, T. F.A.O. Publication, Rome 1965	F - 2 F - 8 F - 6	1 - 40 1 - 7 1 - 11	Aid for teacher to decide the programme.

Reference Books

Subject : COURSE II : FRESH-WATER FISH CULTURE

Standard XII - PAPER I

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
Theory				
1.	Fish and fishery of India By Jhingran, V. G.	2 - 5	625 - 633 541 - 580	
2.	i) Text book of Fish Culture, By Huet, M. ii) Aquaculture Bardach J.E., Ryther J.H. & McLarney W.O.	-	-	Teacher to collect relevant information
3.	i) Text book of Fish Culture	12	291 - 299	
	ii) Fish and fishery of India By Jhingran, V. G.	2 - 5	541 - 624	
	iii) Techniques of Nursery pond Management I.C.A.R. Publication, C.I.F.R.I. Barrackpore, West Bengal	-	1 - 6	
	iv) Intensive Fish Farming I.C.A.R. Publication, C.I.F.R.I. Barrackpore, West Bengal	-	1 - 8	
Practical				
1	i) Exotic Aquarium Fishes By Innes W.T. Metaframe corporation, Maywood, New Jersey, U.S.A.	-	68 - 115	

Reference Books

Subject : COURSE II : FRESH-WATER FISH CULTURE

Standard XII - PAPER II

Unit	Name of the book with Author and Publisher	Corresponding Chapter	Pages	Other Information
Theory				
1.	i) Aquaculture Bardach J.E., Ryther J. H. & McLarney W.O.	1	1 - 28	
2.	i) Costs and earnings investigations of primary fishing the enterprises Ovenden, A.E.F.A.O. Publication Rome 1961			Teacher to collect relevant information for teaching basic principles
	iii) Aquaculture Bardach J.E., Ryther J.H. & McLarney W.O.	-	-	- do -
3.	i) Fish and fishery of India By Jhingran, V. G.	2-1, 2-3	89 - 271	
4-5	i) Exotic Aquarium Fishes By Innes W.T.	-	7 - 115 523 - 529 123 - 520	
Practical				
1.	i) Exotic Aquarium Fishes By Innes W.T.	-	123 - 529	

LIST OF EQUIPMENT FOR STANDARD XI AND XII

COURSE I - FISH PROCESSING TECHNOLOGY

1. Laboratory space for batch of 20 students
2. Chemical balance (2 nos.) of sensitivity of 0.1 mg.
3. Heating gas
4. Storage space

The additional requirement which the centre may not have is as below -

1. Museum specimens of commercially important fish and shell fish such as

			Approx. Cost (Rs.)
i)	White pomfret	(Saranga)	]
ii)	Black pomfret	(Halwa)	]
iii)	Sear fish	(Surmai)	]
iv)	Lacterius	(Soundala)	]
v)	Mullet	(Boi)	]
vi)	Silago	(Renewi)	]
vii)	Ribbon fish	(Bala)	]
viii)	Scianid	(Dhoma)	]
ix)	Harpodon	(Bombil)	]
x)	Clupeids	(Pathurdi)	] Approx.
xi)	Sardines	(Tarli, Kanat, Haid)	] Cost
xii)	Mackerel	(Bangda)	] Rs.1,000/-
xiii)	Shark	(Mushi)	]
xiv)	Prawn	(Kolambi)	]
xv)	Shrimp	(Jawala)	]
xvi)	Lobster	(Shevand)	]
xvii)	Crab	(Khekada)	]
xviii)	Clams	(Tisri)	]
xix)	Oyster	(Kalwi)	]

2. Hot Air drying ovens : 1 No. — 1500/-
3. Autoclave, electrical heating : 1 No. — 3000/-
4. Micro-kjeldahi digestion unit : of six heating elements No. 1 — 1000/-
5. Micro-kjeldahi distillation unit : 6 Nos. — 1500/-
6. Soxhlet distillation apparatus with glass parts : 2 Nos. : of six heating elements — 3000/-

		Approx. Cost (Rs.)
7.	Grinder, Willey type, electrical : 1 No.	2000/-
8.	Microscope with oil immersion objective : 5 Nos.	5000/-
9.	Top-loading balance, capacity 2 Kg. and divisions of 5 g : 2 Nos.	500/-
10.	Bacteriological incubator : 2 No.	2000/-
11.	pH. meter : 1 No.	3000/-
12.	Glass-ware : Burettes, pipettes, conical flasks, micro-kjeldahl digestion flasks, petri dishes, beakers, measuring cylinders, sildes, cover slips, etc.	2000/-
13.	Silica and porcelain ware : Porcelain trays, crucibles with lids, etc.	500/-
14.	Miscellaneous : Reagent bottles, tongs, forceps, knives, filter papers, tubing, etc.	5000/-
15.	Chemicals : Laboratory chemicals, stains and bacteriological chemicals	3000/-
16.	Various teaching aids, such as charts, samples of fishery products, models, etc.	1000/-

COURSE II : FRESH WATER FISH CULTURE

			Approx. Cost (Rs.)
1.	Microscopes	5 Nos.	5000/-
2.	Gillnets	5 Nos.	5000/-
3.	Laboratory aquaria	20 Nos.	2000/
4.	Dissection boxes	10 Nos.	1000/-
5.	Electrical grinder-mixer	1 No.	1000/-
6.	Plastic pools	2 Nos.	1000/-
7.	Aerating pumps	10 Nos.	500/-
8.	Top loading balance	2 Nos.	500/-
9.	Hand operated centrifuges	10 Nos.	500/-
10.	Hand nets	10 Nos.	500/-
11.	Plankton nets	10 Nos.	500/-
12.	Aluminium angles for aquaria	1 No.	500/-
13.	Hack saw	4 Nos.	100/-
14.	Hand drill	4 Nos.	200/-

			Approx. Cost (Rs.)
15.	Punding and pressing tools	4 Nos.	200/-
16.	Glass cutters	5 Nos.	500/-
17.	Glassware	1 No.	3000/-
18.	Chemicals	1 No.	3000/-
19.	Miscellaneous	1 No.	1000/-

Scheme of Examination

FISHERY GROUP

1. Fish Processing Technology

2. Fresh Water Fish Culture

Paper - I

Theory : 50 Marks. Duration : 3 Hrs.

Practical

50* Marks. Duration : 3 Hrs.

* 10 Marks should be allotted to the Journal to be submitted by the student at the time of the practical examination.

Paper - II

Theory : 50 Marks. Duration : 3 Hrs.

Practical

50* Marks. Duration : 3 Hrs.

* 10 Marks should be allotted to the Journal to be submitted by the student at the time of the practical examination.