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UNIVERSITY OF MUMBAI



Syllabus for sem V & VI

Program: B.Sc.

Course: Fishery Biology

(Applied Component)

In Zoology

(Credit based semester and Grading System
with effect from the academic year 2013–2014)

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PREAMBLE

Applied component was introduced for T.Y. B.Sc. class in the academic year 1979-80 with a view to enhance essential for employability. Thereafter the syllabus of T.Y.B.Sc. Applied Component in Zoology has been revised many times. However during the last revision of syllabi, emphasis on entrepreneurial potential and skills has been enhanced by incorporating applied topics having commercial propositions. The BOS also experimented by introducing flexibility in terms of selecting any four out of eight units included in the syllabus during the last revision. The experiment has been successful and appreciated. It is continued in this revised syllabus also.

From the academic year 2010-2011, the University has introduced Credit Based Semester and Grading System with continuous evaluation involving Internal and External Assessment. The revised syllabi in the Applied Component subjects in Zoology are modularized offering opportunity to learners to study any four out of a total of eight units in each course.

The jurisdiction of our esteemed University extends from Colaba in South Mumbai to Banda in Sindhudurga. The diversity of the colleges affiliated to the University in terms of infrastructure, expertise and opportunity has been an important consideration while drafting the syllabus. The syllabus offers freedom to select any four units out of eight in each paper in the semester according to the requirements of the College. This also satisfies the purpose of choice based syllabus.

Thus the revolutionary initiative of the BOS in Zoology, with an inherent flexibility, aimed at providing need based training catering to the needs of rural as well as urban niches has been continued with this revision of syllabi also. However this flexibility is, at present, available for only Applied Component subjects.

T.Y.B.Sc.
Applied Component
Fishery Biology

Credit based semester and Grading System.
 (To Be Implemented from the Academic Year 2013-2014)

Semester V

Theory (Any four units to be opted)				
Course	Unit	TOPIC	Credits	L/Week
USACFBIO501	I	Oceanography	2	4
	II	Crafts and Gear.		
	III	Farming of Major Carps		
	IV	Introduction to other Commercial Aquaculture Practices in Fresh Water.		
	V	Brackish water prawn <i>Penaeus monnodon</i> culture.		
	VI	Introduction to other Commercial Aquaculture in Brackish Water / Marine Water		
	VII	Quality control and Packaging		
	VIII	Marketing and Finance.		
Practicals				
USACFBIO5P1		Practicals based on Course USACFBIO501	2	4

Semester VI

Theory (Any four units to be opted)				
Course	Unit	TOPIC	Credits	L/Week
USACFBIO601	I	Marine Fin Fishes of India.	2	4
	II	Marine Shellfish and Fisheries of India.		
	III	Nutrition.		
	IV	Diseases.		
	V	Preservation and Processing.		
	VI	Byproducts and Value added Products.		
	VII	Farm Engineering.		
	VIII	Introduction to other Aquaculture.		
Practicals				
USACFBIO6P1		Practicals based on Course USACFBIO601	2	4

Semester V: Theory

Oceanography, Aquaculture practices, Marketing and finance

Course code: USACFBIO501

(Any four units to be opted)

Lectures 60

Credits 2

Unit I) Oceanography –

- i) Navigational & sea safety equipments – Life saving devices, global positioning system, radar, signalling devices.
- ii) Oceanographic Instruments – Nansen’s reversing bottle, Peterson’s grab, dredges, fish finding instruments / methods, remote sensing.
- iii) Introduction to basic physical, chemical & biological oceanography.

Unit II) Craft & Gear –

- i) Basic boat building (Parts, Design, Material used), Methods of protection from foulers & borers.
- ii) Basic studies of marine engines – outboard & inboard engines, sectional view of 2 stroke & 4 stroke diesel engines, winch & deck side equipments.
- iii) Operations – Gill, Trawl, Purse seine nets, Hooks & lines, Turtle exclusion device (TED), Non conventional fishing methods such as light fishing, hose pipe fishing, electric fishing,.

Unit III) Farming of Major Carps –

- i) Breeding techniques of Major Carps & Common Carps.
- ii) Hatchery & Nursery Management of Indian Major Carps - *Labeo rohita*, *Catla catla*, *Cirrhina mrigala* & Exotic carps – Common Carp - *Cyprinus carpio*, Silver Carp - *Hypophthalmichthys molyxtrics*, Grass Carp - *Ctenopharyngodon idella*.
- iii) Mono culture & poly culture practices – Extensive, Semi-intensive & Intensive.

Unit IV) Introduction to other Commercial Aquaculture Practices in Fresh Water –

- i) Fresh water prawn - *Macrobrachium rosenbergii* - Breeding, life cycle, hatchery management & rearing, Composite culture.
- ii) Ornamental fishes - Breeding and rearing of Danio, Angel, Discus, Neon Tetra, Red Sword Tail, Flower Horn, Siamese Fighter).
- iii) Air Breathing Fishes - Breeding & rearing.

Unit V) Brackish water Prawn - *Penaeus monodon* - Culture –

- i) Breeding techniques.
- ii) Hatchery & Nursery Management.
- iii) Rearing practices – Extensive, Semi-intensive, Intensive & Sustainable.

Unit VI) Introduction to other Commercial Aquaculture in Brackish / Marine water –

- i) Fin fish culture - *Lates calcarifer*.
- ii) Crab - *Scylla serrata*.
- iii) Pearl - *Pinctada vulgaris*.

Unit VII) Quality Control & Packaging –

- i) Post mortem changes & mechanism of spoilage – Hyperaemia, Rigor Mortis, Autolysis, Rancidity.
- ii) Brief methods for evaluating freshness & quality (Organoleptic, Microbial, and Chemical) of fish & prawns.
- iii) Various packaging materials used in freezing & canning industry – Polyolefin, wax duplex carton, master carton, can, lacquered can.

Unit VIII) Marketing & Finance –

- i) Traditional marketing vis-a-vis role of fishery co-operatives with reference to operations at Satpati, Sasoon Dock & Karanja.
- ii) Global marketing & Export-Import procedures.
- iii) Fund raising – Financial institutions, schemes & subsidies, basic accounting, costing & feasibility report.

Semester V Practical

Course code: USACFBIO5P1

2 Credits

1. Introduction to Oceanographic Instruments - Nansen Reversing Bottle with Thermometer, Peterson's Grab, Dredge.
2. Layout of fishing vessels & Sectional view of 2 strokes & 4 strokes marine engines, life saving equipments, winch & deck side equipments.
3. Identification of various stages of development of carps & Study of sexual dimorphism in adults.
(Major Carps - *Labeo rohita*, *Catla catla*, *Cirrhina mrigala*, Common Carp - *Cyprinus carpio*.)
4. Identification of various stages of development of *Penaeus monodon*, *Macrobrachium rosenbergii* & Study of sexual dimorphism in adults.
5. Identification of Air Breathing Fishes – *Anabas testudineus*, *Clarius batrachus*, *Boleophthalmus* spp.
6. Identification of :
 - A) Ornamental fishes - Angel, Sword Tail, Neon tetra, Siamese fighter, Danio, Discuss and Flower Horn.
 - B) Aquatic plants – Ludwigia, Cobamba, Cork Screw Vallisneria, Aquarose, Amazon Sword plant &
 - C) Aquarium accessories – Aerator, Bottom Filter, Column Filter, Surface Filter, Food dispensers.
7. Study of models and functioning of D 81 & Shirgur's hatcheries.
8. Embedding beads in suitable mollusc (Such as *Unio sp*; *Katelysia sp.*) under sterilized conditions for pearl culture.
9. Microbial Studies – i) Dilution of Sample, ii) Gram Staining Technique, iii) Identification of Bacilli, Cocci, Vibrio bacteria and Organoleptic tests for fish & prawn.
10. Total Plate Count (TPC) of bacteria from fish.
11. Identification of packaging materials.
(Waxed duplex carton, Master carton, Simple cans, Coated [Lacquered] cans, Polyolefin).
12. Group Activities - Field Visits & Entrepreneurial Skill Development.

[Please refer the Annexure for the suggested topics for field visits (Annexure-I), and entrepreneurial skill development (Annexure- II) for Course code: **USACFBIO5P1**]

Semester VI: Theory
Marine resources, post harvest and farm engineering

Course code: USACFBIO601

(Any four units to be opted)

Lectures 60

Credits 2

Unit I) Marine Fin Fish Fisheries of India –

- i) Coastal fisheries (up to 45 fathoms) – *Stromateus sinensis*, *Stromateus cinereus*, *Stromateus niger*, *Polynemus tetradactylus*, *Psuedosciaena diacanthus*, *Trichiurus haumela*, *Synagris saponicas*, *Scomber microlepidotus*, *Cybium guttatum*, *Sardinella longiceps*.
- ii) Deep sea fisheries (more than 45 fathoms) of Indian Exclusive Economic Zone – *Thunnus albacore*, *Sarda orientalis*, *Rhincodon typus*.
- iii) Commercial potential & major landing centres of the above fishes.

Unit II) Marine Shell Fish Fisheries of India –

- i) Crustacean fisheries – *Penaeus monodon*; *Metapenaeus affinis*, *Parapenaeopsis stylifera*, *Acetes indicus*, *Panulirus polyphagus*, *Scylla serrata*.
- ii) Molluscan fisheries – *Pinctada vulgaris*, *Sepia pharaonis*, *Loligo duvacei*.
- iii) Commercial potential & major landing centres of the above shell fishes.

Unit III) Nutrition –

- i) Nutritional requirements at various stages of development of fish & crustaceans.
- ii) Culture of natural feed – *Daphnia*, *Chaetoceros* & *Artemia*.
- iii) Formulated / Pelleted feeds.

Unit IV) Diseases –

- i) Bacterial, Fungal, Protozoan infections and treatment.
- ii) Worm & Crustacean infections and treatment.
- iii) Physiological disorders / diseases and treatment.

Unit V) Preservation & Processing –

- i) Traditional methods of icing, drying, salting & their modifications.
- ii) Introduction to refrigeration, types & properties of refrigerants, types of freezers – Brine, air blast, tunnel, contact plate & cryo-quick. Freezing procedures including hygienic washing, dressing, PUD (Peeled & Undeined), DV (Deveined), packaging and freezing for fishes, prawns & their products.
- iii) Principle & steps involved in can reform & canning of fish & prawns in various media.

Unit VI) By-products & Value Added Products –

- i) Proximate composition of fish meat & products.
- ii) Introduction to by-products – Fish protein concentrate, Fish maws / Isinglass, Fish hydrolysates, Chitin, Chitosan, Glucosamine hydrochloride, Gelatin, Fish silage, Surimi & Imitation products.

- iii) Value addition – Different types of value added products from fish & shell fish – Fish / Prawn pickle, Fish wafers, Prawn (*Acetes indicus*) chutney, Fish soup powder, Fish / Crab steaks.

Unit VII) Farm Engineering –

- i) Site selection & construction of hatchery & farms for Extensive, Semi-intensive & Intensive fresh water fishes.
- ii) Site selection & construction of hatchery & farms for Extensive, Semi-intensive & Intensive brackish water fishes.
- iii) Equipments & Accessories used in various aqua farms.

Unit VIII) Introduction to other Aquaculture Practices –

- i) Raft culture, Rope culture.
- ii) Pen culture, Cage culture.
- iii) Sports fishery, Sewage fed culture.

Semester VI **Practical**

Course code: USACFBIO6P1

Credits 2

1. Identification of marine fishes.
(*Stromateus sinensis*, *Stromateus cinereus*, *Stromateus niger*, *Polynemus tetradactylus*,
Pseudosciaena diacanthus, *Trichiurus haumela*, *Synagris japonicus*, *Scomber microlepidotus*,
Cybium guttatum, *Sardinella longiceps*, *Thunnus albacore*, *Rhincodon typhus*, *Sarda orientalis*).
2. Identification of Crustaceans & Molluscs.
(*Penaeus monodon*, *Metapenaeus affinis*, *Parapenaeopsis stylifera*, *Acetes indicus*,
Panulirus polyphagus, *Scylla serrata*, *Pinctada vulgaris*, *Sepia pharaonis*, *Loligo duvaceli*).
3. Estimation of fish fecundity.
4. Estimation of fat/lipid from fish by Folch's Method & proteins by Lowry's Method.
5. Preparation of formulated feed for fish & prawn.
6. Identification of parasitic infections in aquatic organisms.
Fungal – Dermatomycosis; Bacterial – Fin/Tail rot & Dropsy; Protozoan – Costiasis & White Spot; Worm – Leech; Crustacean – Argulosis.
7. Fish dressing, filleting, prawn peeling – PUD, DV & grading.
8. Preparation of surimi, fish protein concentrate, fish soup powder.
9. Preparations of fish burger, fish fingers, fish/prawn pickle.
10. Preparation of chitosan, isinglass.
11. Identification of various farm equipments such as feeding cups, trays, paddle wheels, aerators, fountains, Sluice gate models, elbow pipe outlets.
12. Study of models of raft, pen, cage culture & materials used in rope culture.
13. Project (individual activity) and assignment (group activity).

[Please refer the Annexure for the suggested, topics for Projects (Annexure-III) and Assignment (Annexure- VI) for Course code: **USACFBIO6P1**]

N.B :

I) It is pertinent to note that we have to adhere strictly to the directions as given in the UGC Circular F14-4/2006 (CPP-II).

II) Apart from the institutional Animal Ethics Committee (IAEC) and any other Committee appointed by a Competent Authority/Body from time to time, every college should constitute the following Committees :

- 1) A Committee for the Purpose of Care and Supervision of Experimental Animals (CPCSEA) and
- 2) A Dissection Monitoring Committee (DMC)

Composition of DMC shall be as follows :

- i) Head of the Concerned Department (Convener/Chairperson)
- ii) Two Senior Faculty Members of the concerned Department
- iii) One Faculty of related department from the same College
- iv) One or two members of related department from neighbouring colleges.

References

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- Fish & Fisheries in India – By Jhingran V.G. – Hindustan Pub. Corporation – New Delhi.
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- Hand Book of Fresh Water Fishes of India By Beaven C.R. – Narendra Pub. House.
- Fish Biology By C.B.C. Srivastava – Narendra Pub. House.
- Ecological Methods for Field & Laboratory Investigations By P. Michael.
- Fish & Fisheries By Chandy – National Book Trust.
- The Book of Indian Shells By Deepak Apte – Oxford Uni. Press.
- Fisheries Bioeconomics – Theory, Modelling & Management – FAO Fisheries Technical Paper 368 – FAO, 2001.
- Modern Fishing Gear Technology By N. Shahul Hameed, Boopendranath – Daya Pub. House – 2000.
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- Handbook of Fish Biology and Fisheries Edited By J.B. Hart & John Reynold.
- Course Manual in Fishing Technology By Latha Shenoy, CIFE, Versova, Mumbai.
- An Introduction to Fishes By Khanna S.S. – Central Book Depot, Allahabad (1993).
- Text Book of Fish Biology and Indian Fisheries By Dr. R. P. Parihar, Central Pub. House, Allahabad.
- Financial management By Prasanna Chandra- Seventh Edition.
- Financial management By Khan & Jain.

- Financial management By I. M. Pandey.
- Project Management By Prasanna Chandra.
- Marketing Management By Philip Kotler.
- For Additional and Latest Information on the topics, various Web Sites can be visited.

Annexure -I

Suggested Field Visits

(Semester V: Group activity)

Course code: USACFBIO5P1

Field visits are to be organised to facilitate students to have firsthand experience and exposure to technology / production / functioning of an organisation / unit or witness a relevant activity.

Each student must make at least 01 (One) such visits to the units/markets/sea shores out of 2 to 3 such visits organised by the college.

I) Visit to one of the units with one or multiple activities such as .

- Ornamental / Brackish water / Fresh water fish farm / hatchery.

II) Visit to witness one of the activities such as

- Fish angling / trawling / purse seining / gill netting.
- Fish finding operations, etc. (Echo Sounder/Sonar/Fish Magnifier).

III) Visit any production units such as

- Food / Fish processing and preservation.
- Ornamental articles.

IV) Hi-tech and multinational total export oriented units such as

- IQF plant.
- Surimi plant.
- Fishery plant.
- Microbiological units.
- Hi-tech fish / prawn / chick hatcheries.
- Fish consumer product industries.

V) **Others –**

- Self Sale Groups.
- Co-operative Societies.

VI) **Govt. Offices** such as

- Fishery Department.
- MPEDA.
- Wild-life Authority.
- CITES.
- JDEI (Jt. Director-Export & Import).
- Sales Tax.
- Income Tax.
- Excise Dept.
- Customs Authority of India.

- Local Self Govt. (BMC).
- Clearing Agencies /Agents.
- FDA.
- ISI.
- Ag Mark, etc.

VII) Visit any ancillary unit such as

- Ice plant.
- Can reforming.
- Packaging.
- Cold storage.

VIII) Visit to National Laboratories, National Research Labs & Training Institutes such as NIO, CIFE, CMFRI, CIFT, FSI, IFP, CIFI, CIFNET, NBFGR, etc.

(Field visit is desirable to know the organization; however guest lecturers could also be helpful in understanding functioning).

Annexure -II

Suggested Topics For Entrepreneurial Skill Development

(Semester V: Group activity)

Course code: USACFBIO5P1

1. Curing & drying of jew fish (Dhoma), Ribbon fish, Bombay-duck.
2. Preparation / Collection of different fibres & their specifications.
3. Preparation of aquarium fish feed.
4. Setting & Maintenance of fresh water aquarium.
5. Setting & Maintenance of marine aquarium.
6. Breeding of various aquarium fishes.
7. Collection of various types of Hooks used in fishing.
8. Maintenance of Daphnia Culture and Tubifex worms, Rotifer culture, Artemia Culture.
9. Study of shelf life of desired products such as prawn pickle, fish wafers, fish burger.
10. Breeding of Prawns.
11. Breeding of aquarium fishes.

12. Rearing of aquarium fishes.
13. Propagation of aquatic plants.

Annexure -III
Suggested Topics For Individual Project
Course code: USACFBIO6P1

1. Feasibility report of the maintenance of aquarium fishes in high profile residences.
2. Feasibility report of fresh water / brackish water fish / prawn culture for extensive, semi intensive and intensive.
3. Probability report of maintenance of a culture of Chaetoceros & Artemia by the fish farmers.
4. Project report for the establishment of small / medium / large scale ice factory, freezing and canning industry.
5. Feasibility report of various packaging materials in freezing / canning industry.
6. Feasibility report for establishing an aquarium shop.
7. Feasibility report for establishing a fish feed industry.
8. Monitoring various physico-chemical parameters of an aquarium / pond / lake / river / sea.

Annexure -IV
Suggested Topics For Group Assignments
Course code: USACFBIO6P1

1. Study of market survey for various preserved & processed fish / prawns.
2. Handling of fish on board, at landing centre, in secondary market & at consumer level.
3. Preparation of by products from fishes /crustaceans /molluscs & its costing / production cost.
4. Survey of fish markets for fluctuation in the availability & price of fishes.

5. Survey of the local market for the availability of various by products, value added products and its price.
6. Study of economics of brackish water pond culture.
7. Study of working of fisheries co-operative societies.
8. Study of cost of construction of fishing vessel and subsidies available for the same.
9. Study of cost of gear manufacturing with different materials and subsidies available for the same.
10. Study of cost & profit analysis of any one of the following methods - Trawler, Gill netter, Purse seiner, Hooks & lines and Non-mechanised fishing units.
11. Survey of various packaging materials used in fish processing industries.
12. Survey of various feeds used in local aqua farms.
13. Study of economics of pond culture from nearby area.
14. Comparative cost analysis of fingerlings of major carps from your area.
15. Setting up of marine aquarium with various accessories and its costing.
16. Construction of aquaria of different sizes and shapes.
17. Study of various courses run by Institutes in your area in relation to fisheries.

[ALL THE TOPICS SUGGESTED ABOVE ARE SUGGESTIVE IN NATURE AND MORE CREATIVE AND INNOVATIVE NEW TOPICS ARE EXPECTED FROM THE STUDENTS UNDER ABLE GUIDANCE OF CONCERNED TEACHERS, TO SUIT THE EXPERTISE, HUMAN RESOURCES, INFRASTRUCTURE AND LOCAL NEEDS AS ALSO THE INTEREST OF THE STUDENTS.]

Modality of Assessment :

Theory Examination Pattern:

A) Internal Assessment - 40% marks. Theory 40 marks

Sr No	Evaluation type	Marks
1	One Assignments/Case study/Project	10
2	One class Test (multiple choice questions / objective)	20
3	Active participation in routine class instructional deliveries(case	05

	studies/ seminars//presentation)	
4	Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

B) External examination - 60 %

Semester End Theory Assessment - 60%

60 marks

- i. Duration - These examinations shall be of two and half hours duration.
- ii. Theory question paper pattern :-
 1. There shall be **five** questions each of **12** marks. On each unit there will be one question & fifth one will be based on all the four units .
 2. All questions shall be compulsory with internal choice within the questions. Each question will be of **24** marks with options.
 3. Questions may be sub divided into sub questions a, b, c & d only, each carrying **six** marks **OR** a, b, c, d,e & f only each carrying **four** marks and the allocation of marks depends on the weightage of the topic.

Practical Examination Pattern:

(A)Internal Examination:-

There will not be any internal examination/ evaluation for practicals.

(B) External (Semester end practical examination) :-

Sr.No.	Particulars	Marks
1.	Laboratory work	80
2.	Journal	10
3.	Viva	10

Assessment pattern for semester end / External practical examination of 80 marks shall be finalized in the workshop of the subject

Semester end practical examination in applied component shall be conducted by the concerned department of the Institute/ College at the end of each semester and the marks of the candidates are to be sent to the University in the prescribed format.

Semester V:

Practical examination will be held at the college / institution at the end of the semester.

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department ; failing which the student will not be allowed to appear for the practical examination.

Semester VI

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department ; failing which the student will not be allowed to appear for the practical examination.