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Item no. 4.35

UNIVERSITY OF MUMBAI



Syllabus for Sem V & VI
Program: B.Sc.
Course: Marine Science
(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
Marine Sciences

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
USACMSC501	I	Zonation in the Sea and Marine Biodiversity	2	4
	II	Physical Oceanography and Ocean Related Climatic Changes		
	III	Chemical Oceanography		
	IV	Fishing Craft and Gear		
	V	Oceanographic Instruments		
	VI	Regulation and Deep Sea Exploration		
	VII	Entrepreneurship Opportunities and Status of Research in marine Science.		
	VIII	Protection and Conservation		
Practical				
USACMSC5P1		Practicals based on Course USACMSC501	2	4

Semester VI

Theory (Any four units to be opted)				
Course	Unit	TOPIC	Credits	L/ Week
USACMSC601	I	Organic Production in the Sea.	2	4
	II	Culture of <i>Penaeus monnodon</i>		
	III	Introduction to other Commercial Aquaculture		
	IV	Specialized marine Ecosystem and Anthropogenic Impact on marine Environment		
	V	Introduction to Quality Control, Preservation and Processing		
	VI	Fish as Food.		
	VII	Fish Pathology.		
	VIII	Financial management and Marketing.		
Practical				
USACMSC6P1		Practicals based on Course USAC-MS601	2	4

Semester – V **60 lectures**
Theory
Oceanography, fishing Crafts and Gears
Course code: USACMSC501 **2 Credits**
(Any four units to be opted)

Unit I: Zonation of the Sea and Marine Biodiversity

1.1 Zonation of the Sea – Vertical and Horizontal

1.2 a) Plankton Classification and Adaptations

b) Nekton Adaptations

1.3 Benthos Adaptions

a) Inter-tidal organisms (rocky, muddy & sandy shores)

b) Deep Sea

Unit II: Physical Oceanography and Ocean Related Climatic Changes

2.1 Effect of the following physical parameters of the sea

a) Density

b) Illumination

c) Temperature

2.2 Influence of the following water movement in sea

a) Currents – Wind Driven and Thermohaline Circulation

b) Types of Waves (including Tsunami)

c) Tides

2.3 Influence of the following climatic parameters/phenomena

a) Monsoon

b) Cyclone (including phyan)

c) El Nino

Unit III: Chemical Oceanography

3.1 Effect of the following chemical parameters of the sea water

a) Salinity

b) pH

c) Dissolved Gases (Oxygen and Carbon dioxide)

3.2 Effect of the following nutrients in sea water

a) Minor constituents (Nitrates, Phosphates and Silicates)

b) Dissolved Organic matter

3.3 Ecological cycles in the Ocean

a) Oxygen Cycle

b) Nitrogen Cycle

c) Sulphur Cycle

d) Phosphorus Cycle

Unit IV: Fishing Craft and Gear

4.1 Traditional and Modern Fishing Craft

a) Non mechanized craft -dugout canoe, plank built boats and FRP boats.

b) Motorized craft with outboard and inboard engines.

c) Mechanized craft and their various operations- bag net, large gill net, bottom trawls, Purse seines, long line and squid jigging.

4.2 Types of gill nets (surface, drift, bottom set) Dol net, Purse seines, Cast net, Tuna long line, Squid jigs, Rampani net, and Hooks & line.

4.3 Pelagic and Bottom trawls

Unit V: Oceanographic Instruments

5.1 Instruments used for Marine Biological Sampling

- a. Nansen Reversing Water Bottle
- b. Dredge and Petersen Grab
- c) Plankton net (Typical Plankton net, Hensen Net & Indian Ocean Standard Net)

5.2 Instruments used for Measurement of Physical Factors

- a. Protected and Unprotected Reversing thermometer
- b. Current meter
- c. Secchi disc and Echosounder

5.3 Fishing methods with respect to location and harvesting

- a. GPS
- b. SONAR
- c. Remote Sensing and Satellite Imagery

Unit VI: Regulation and Deep Sea Exploration

6.1 Regulation: Marine fisheries Acts, CCRF (Code of Conduct for Responsible Fisheries), Problems of Overfishing and its regulation: Closed seasons, closed area, capture size restrictions.

6.2 Exclusive Economic Zone and Deep Sea Fishing

6.3 Study of the following Expeditions

- a) Challenger
- b) Indian Ocean
- c) Antarctica

Unit VII: Entrepreneurship opportunities and status of research in marine science

- a) Maintenance of Marine aquarium,
- b) Research Institutes: NIO, CMFRI, CIFE, FSI, CIBA, AND MPEDA.
- c) Introduction to web sites related to marine science

Unit VIII: Protection and Conservations

- 8.1 Endangered, threatened and vulnerable marine species
- 8.2 Marine protected areas (MPA)
- 8.3 Marine park and bio reserve

Semester-V

60 lectures

Practical

Course code: USACMSC5P1 2 Credits

1. Chemical Analysis of Sea Water: Silicates, Phosphates, Nitrates, Carbon Dioxide, pH and Salinity

2. Study of Oceanographic Instruments:

Nansen Reversing water bottle
Dredge and Petersen Grab
Reversing thermometer
Current meter
Secchi disc
Standard Plankton net
Echosounder and Trawl

3. Ecological Adaptations: Intertidal Animal

Porifera-sponge (Sycon)

Coelenterata-Obelia / Sertularia, Sea-anemone, Coral
Annelida-Nereis, Arenicola, Chaetopterus, Sabella
Arthropoda-Balanus, Lepas, Hermit Crab
Mollusca-Patella, Chiton, Trochus, Oyster, Mytilus, Sepia, Octopus, Loligo, Teredo
Echinodermata- Brittlestar, Starfish, Sea urchin, Holothurian, Sea-lily
Deep Sea Animals – Solefish (Psettodes, Cynoglossus), Angler Fish

4. Study of Zooplankton : Sorting, Mounting and Identification

5. Estimation of Plankton Biomass: Displacement / Settlement Method

6. Setting of Marine aquarium (case study)

7. Endangered marine species: Identification & ecological status of Sea-lion, Seal, Whale, Salmon and Sturgeon etc.

8. Visit to any of the Research Institutes and Submission of Report

Semester VI
Theory

60 lectures

Marine Ecosystem, Fish pathology, Marketing and Finance

Course code: USACMSC601

2 Credits

(Any four units to be opted)

Unit I: Organic Production in the Sea

1.1 Concept of Productivity, Standing Crop and Biomass

1.2 Brief outline of Measurement of Organic production

- a) Standing stock Measurement
- b) Measurement of Nutrient uptake
- c) Measurement of Photosynthesis

1.3 Factors Regulating Production

- a) Light,
- b) Temperature,
- c) Nutrients
- d) Grazing Rate

Unit II: Culture of *Penaeus monodon*

2.1 Identification of various stages of Life Cycle

2.2 Breeding techniques and hatchery management

2.3 Rearing practices – Extensive, semi-intensive and intensive

Unit III: Introduction to other Commercial Aquaculture

3.1 Rearing of Fin fish (*Lates calcarifer*)

3.2 Culture of Marine algae

3.3 Culture of molluscs:

- a) *Mytilus*
- b) Oyster (edible and Pearl oyster)

Unit IV: Specialised Marine Ecosystem and Anthropogenic impact on Marine Environment

4.1 Specialised Marine Ecosystem:

- a) Mangroves and Wet lands
- b) Coral reef
- c) Salt marshes and backwaters

4.2 Anthropogenic stresses due to claiming of land

- a) Reclamation
- b) Destruction of Mangroves

4.3 Anthropogenic stresses due to dumping of waste

Domestic Sewage, Oil Spillage, Pesticides, Radioactive and Thermal Wastes.

Unit V: Introduction to Quality Control, Preservation and Processing

5.1 Determining quality & spoilage:

- a) Brief method of evaluating fish freshness and quality (Organoleptic, Microbical and Chemical) of fish and prawn.
- b) Mechanisms of spoilage (Hyperemia, Rigor mortis, Autolysis, Rancidity)

5.2 Traditional and modified methods of preservation

- a) Icing
- b)Drying
- c)Salting
- d)Canning
- e)Pickling
- f)Referigation

Unit VI: Fish as food

6.1 a) Biochemical composition of raw fish & nutritional value of raw, preserved and processed fish.

6.2 Fish by product: Fish protein concentrate, fish maws, ising glass, oils (body and liver), citosan, shark fin rays

6.3 Value added products: Fish/ Prawn pickle and chutney, fish wafers, surimi, imitation products.

Unit VII: Fish pathology

a) Fish diseases caused by:

- i) Protozoan
- ii) Bacteria
- iii) Fungal
- iv) Worms
- v) Crustaceans
- vi) Non parasitic diseases

b) Symptoms and treatment of the above diseases

Unit VIII: Financial Management and Marketing

8.1 Procuring Finance

- a) Financial Institutions and Funding Agencies
- b) Schemes and basic subsidies

8.2 Financial Management- Costing, Budgeting Fund Flow, Auditing and Preparation of Feasibility report

8.3 a) Traditional marketing vis-à-vis operations of fishery co-operatives (Sasoon, Karanja, Satpati Model)

- b) Global Marketing
- c) Export-Import Procedures

Semester-VI

60 lectures

PRACTICAL

Course code: USACMSC6PI

Credits 2

1. Organic Production: Estimation of Primary Production using Dark and Light Bottle

2. Estimation of Biological Oxygen Demand (BOD)

3. Estimation of Chemical Oxygen Demand (COD)

4. Identification of Common Fishery Specimens:

Carcharius sps, Polynemus sps, Clupea toli, Lates calcarifer Sciaena sps, Pampus chinensis and Pampus argentieus, *Fo o niger*, *Rastrelliger kanagurta*, *Cybiium guttatum*, *Harpodon nehereus*, *Chii ntrus dorab*, *Muraenesox sps*, *Coilea dussumeri*, *Upenoides sps*, *Sardinella longiceps*, *Katelysia sps*, Oyster, *Sepia*, *Penaeus monodon*, Lobster, Crab (*Scylla serrata*)

5. Identification of Shells:

Littorina, *Turitella*, *Trochus*, *Umbonium*, *Nerita*, *Babylonia*, *Murex*, *Oliva*, *Natica*, *Conus*, Conch Shell, *Telescopium*, *Arca*, *Mytilus*, *Ostrea*, *Donax*, *Katelysia*.

6. Determining feeding habits of fish from jaws, gills & gut contents.

7. Identification of common marine algae – *Ulva*, *Enteromorpha*, *Sargassum*, *Padina*, *Caulerpa*, *Fucus*, *Polysiphonia*, *Batrachospermum*, *Codeum*, *Laminaria*,

8. Identification of common mangrove – *Avicenia*, *Exoecorea*, *Sonnertia*, *Rizophora*

9. Prawn pickling

10. Fish diseases – Identification from photograph / specimen

11. Project

(Project should be based on any applied topic from paper Semester V or Semester VI Theory Paper topics, to be assigned to individual student. The internal assessment will be done through examination of project report, presentation of data and viva-voce.)

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
- One or two members of related department from neighboring colleges.

ANEXURES

Annexure I: Suggested field visits USACMSC5P1

1. Visit to net manufacturing industry
2. Visit to boat building industry
3. Visit to fish preservation/ processing industries
4. Visit to local fish markets
5. Visit to fish landing centre
6. Visit to shore for studying economically important intertidal organisms

Annexure II: Suggested topics for entrepreneurial skill development (Play and ponder) USACMSC5P1

1. Collection of economically important marine shells and preparing artifacts
2. Preparation of any of the fish by products like pickles/ chutneys
3. Model making of locally available fishing nets

4. Setting up and maintenance of marine aquarium
5. Preparation of herbarium and greeting cards of marine algae

Annexure III: Suggested topics for projects. USACMSC6P1

1. Prepare feasibility report for setting up an aquarium shop on small/large scale
2. Prepare feasibility report for setting up an industry and manufacturing any one or more fish byproducts
3. Prepare feasibility report on building up a fish culture unit
4. Prepare feasibility report on building up a prawn culture unit
5. Prepare feasibility report on building up a penaeus culture unit
6. Prepare feasibility report on various aspects of fish processing unit
7. Prepare feasibility report on various aspects of ice and refrigeration units
8. Prepare feasibility report on fish preservation unit
9. Collection and display of shore shells of any coast
10. Study of seasonal variation in nutrient content of marine water of any coast (silicates, phosphates, nitrates)
11. Analysis of marine water samples collected from different beaches (DO/BOD/COD/Salinity/pH)
12. Comparative study of sand samples from different beaches
13. Study of Mangroves of coastal region
14. Survey of fish byproduct in Cosmetic industry
15. Survey of fish byproduct in Pharmaceutical industry

Annexure IV: Suggested topics for assignment USACMSC6P1

1. Survey of marine fishes in Mumbai markets
2. Study of funding agencies for purchase of trawlers
3. Survey of marine fish by products on a commercial basis
4. Report on preservation methods of marine fishes
5. Marine water pollution-causes and remedies

6. Survey of funding agencies and formalities of setting up any Marine by product industry

REFERENCES Marine Science USACMSC501 & USACMSC601

- A Textbook of Marine Ecology – Nair, N.B. & Thumphy, D.H., the Macmillan Book Company of India Ltd.
- The Oceans – Svedrup, H.V. et al, Asian Publishing House
- Marine Ecology – Tait
- Marine Fisheries of India - D.V. Bal and K.V. Rao, Tata McGraw – Hill Publishing Co. Ltd., New Delhi
- Introductory Oceanography – 8th Edn. Harold Thurman, Prentice Hall
- Fisheries Biology, Assessment and Management – Michael King – Fishing News Publishers, 1995
- Glimpses of the Indian Ocean – S.Z. Qasim, University Press (India Ltd. 1998)
- Handbook Fish Biology and Fisheries, Ed. J.B. Hart & John Reynold
- Modern Fishing Gear Technology – N. Shahul Hameed, Boopendranath – Daya Publishing House, 2000)
- Fisheries Bioeconomics – Theory, Modeling and Management – FAO Fisheries Technical Paper 368 – FAO, 2001
- Wealth of India: Vol. 4 CSIR Publication.
- Fish and Fisheries – Chandy, National Book Trust.
- The Book of Indian Shells – Deepak Apte, Oxford University Press.
- Understanding The Sea – Dr. B.F. Chhapgar, Oxford University Press.
- History Of Marine Sciences in India - Dr. B.F. Chhapgar Centenary issue BNHS.
- Crafts and Gear of India – Y.Shrikrishna & Latha Shenoy – ICAR Publication.
- Prawn and Prawn Fisheries – Kurian & Sebastian.
- Ecological Methods for Field and Laboratory Investigations – P.Michael.
- Course Material in Fishing Technology - Latha Shenoy, CIFE, Versova, Mumbai.
- Financial Management – Prasanna Chandra, 7th Edition.
- Financial Management – Khan & Jain .
- Financial Management –I .M. Pandey .
- Project Management - Prasanna Chandra.
- Marketing Management – Philip Kotler.
- For additional and latest information on the topics, various websites can be visited.
- Refrigeration by Arora
- Text book of fish biology and Indian Fisheries by Dr. R.P. Parihar, Central Publication House, Allhabad.

Modality of Assessment :

Theory Examination Pattern:

A) Internal Assessment - 40% marks.

40

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 studies/ seminars//presentation)	05
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.

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