Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE

Syllabus

for

S. Y. B. Sc. (Zoology)

[Pattern 2019]

(B.Sc. Semester-III and Semester-IV)

From Academic Year

2020-21

Deccan Education Society's
Fergusson College (Autonomous), Pune-4

S.Y.B.Sc. Zoology (Pattern 2019)

From academic year 2020-21

Particulars	Name of Paper	Paper Code	Title of Paper	No. of Credits
S.Y. B.Sc. Semester III	Theory Paper - 1	ZOO2301	Life and diversity of Animals-III	2
	Theory Paper - 2	ZOO2302	Applied Zoology- I	2
	Practical Paper - 1	ZOO2303	Practical -III	2
S.Y. B.Sc. Semester IV	Theory Paper - 3	ZOO2401	Life and diversity of Animals-IV	2
	Theory Paper - 4	ZOO2402	Applied Zoology- II	2
	Practical Paper - 2	ZOO2403	Practical -IV	2

S.Y. B.Sc. Semester III

Subject – Zoology Paper –I (ZOO2301): Paper title – Life and diversity of Animals-III.

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Students will learn general taxonomic rules to classify the animals belonging to molluscs, Annelids and arthropods

CO2 Understand the diversity of Molluscs, Annelids and Arthropods.

CO3 Demonstrate the structure and function of Sea star.

CO4 Understand the behavioral relationship between different invertebrate animals.

Unit	Details	Lectures
I	**Salient features and classification up to subclass of the following Phylum's** with reference to: (any one example from each) : **1.1 Phylum Mollusca** General Characters of Phylum Mollusca Classification of Phylum Mollusca up to subclass level. **1.2 Phylum Annelida** General Characters of Phylum Annelida Classification of Phylum Annelida up to subclass level. **1.3 Phylum Arthropoda** General Characters of Phylum Arthropoda Classification of Phylum Arthropoda up to subclass level. **1.4 Phylum Echinodermata** General Characters of Phylum Echinodermata Classification of Phylum Echinodermata up to subclass level.	**[14]**
II	**General topics** 2.1 Mouthparts in Insects 2.2 Metamorphosis in Insects 2.3 Mimicry in Insects 2.4 Bioluminescence in Fireflies 2.5 Larval forms of Class *Crustacean* 2.6 Shell and foot modification in *Molluscs* 2.7 Types of Pedicellariae in sea star.	**[10]**

III	**Biology of Sea star (*Asterias*)** 3.1 Systematic Position, Habit and Habitat 3.2 External Characters 3.3 Digestive System 3.4 Water Vascular System 3.5 Circulatory System 3.6 Reproductive System 3.7 Development of Sea star 3.8 Autotomy and Regeneration	**[12]**

Books-

1. Invertebrates Third Edition by Richard C. Brusca Wendy Moore Stephan M. Shustan
2. Animal Diversity third edition by Cleveland P. Hickman, Jr. Larry S Robert, Allan Larson
3. Invertebrate Zoology by Rupert and Barness
4. Text Books of Zoology. Vol.11, Invertebrates, A. J. Marshall And W. D.Williams, ELSB And Macmillan, Hongkong.
5. Invertebrates Zoology, E.L. Jordan and P.S. Verma; S. Chand and Co. Ltd., New Delhi.14th fully Revised Edition
6. Invertebrate Zoology, Ruppert and Barnes, 6th Edition.
7. An Introduction to Mollusca. H. S. Bhamrah, Kavita Juneja. Anmol Publications Pvt.Ltd. New Dehli- 110002 (India).
8. Life of Invertebrates, S. N. Prasad, Vikas Publishing Co. Sahldabad.
9. The Invertebrates, Echinodermata Vol- IV, L.H. Hyman, International books and periodicals supply services Dehli.
10. An Introduction of Echinodermata. . H. S. Bhamrah, Kavita Juneja. Anmol Publications Pvt. Ltd. New Dehli- 110002 (India).
11 Invertebrate Zoology R. D. Barnes, Saunders College, Philadelphia.
12 Text Books of Zoology, Invertebrates Vol- II, T.J.Parker and W.A. Haswel, Edited by Marshall and Williams, CBS publications and distribution, New Dehli.
13 Invertebrate Zoology, Paul, A. Meglitch and Fedricks R. Schram, Oxford University Press, New York.
14 . Modern Text Book of Zoology. Invertebrates. 6th Edition, R. L. Kotpal, Rastogi Publication, Meerut.

S.Y. B.Sc. Semester III

Subject- Zoology Paper -II (ZOO 2302): Paper title Applied Zoology-I

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Identify different types of freshwater and marine Fishes.

CO2 Learn to develop, operate and manage fish culture production systems so as to start their own fish farm.

CO3 Exploit and utilize wisely fisheries resources using appropriate and innovative fishing methods.

CO4 Learn different fish preservative techniques.

	FISHERIES I	
Unit-I	1.1 An introduction to fisheries and its types : A)Inland fisheries-Riverine, Lakesterine, Cold water and Estuarine fisheries. 1.2 Marine Fisheries- Stratification of marine habitat, Zone of marine habitat. 1.3 Group of marine Fishery: Coastal/Inshore fisheries and Deep sea /Offshore fisheries.	**06**
Unit – II	2.1 Types of culture, characteristics of culturable fishes . 2.2 Study of different ponds in a fish farm : Breeding pond and its types. Hatchery /Hapa – Traditional and modern hatchery, Nursery pond , Rearing pond and Stocking pond 2.3 Types of breeding-Natural and Induced,.	**05**
Unit – III	3.1 Habit, habitat and culture methods of Rohu (*Labeo rohita),* 3.2 Habit, habitat and culture methods of Catla (*Catla catla*). 3.3 Habit, habitat and culture methods of Mrigal (*Cirrhinus mrigala)*	**03**
Unit - IV	**4.1** Pearl culture . 4.2 Harvesting methods of following marine water forms : Bombay Duck and	**04**

	Mackerel	
Section - FISHERIES II		
Unit –V	5.1 Introduction to Prawn Fishery and Integrated Fish farming. 5.2 Types of prawn fishery, rearing system. 5.3 History, Principle, Salient features, scope and importance of integrated fish farming.	**04**
Unit – VI	6.1 Cage Culture and Pen Culture –Shape ,size and types of cages.Principle aim of cage culture. 6.2 Advantages and disadvantages of cage culture. 6.3 Introduction to Pen Culture- History, Types of barriers in Pen Culture, merits and demerits of pen culture	**04**
Unit – VII	7.1 Crafts and Gears in Indian Fishery. 7.2Crafts –Catamaran, Machwa, Dug out canoe, 7.3 Gears –Gill net, Dol net, Purse net, Rampani net, Cast net.	**04**
Unit – VIII	8.1 By-products and Preservation Technique : Fish meal, Fish flour, Liver oil and Body oil and its extraction methods , Ising glass, Fish glue, Fish manure and Fish fin soup. 8.2 Preservation Technique: Sun Drying, Salting, Freezing, Chilling and Canning.	**03**
Unit – IX	Icfthyogeography	**03**

Books-

1) A Text Book of Marine Ecology by Nair M.B. and Thumpy D.H. – Tata MacGraw Hill Pub. – New Delhi.

2) An Introduction to Fishes by Khanna S.S. – Central Book Depot, Allahabad (1993).

3) Aquaculture, Principles and Practices by Pillay T.V.R. – Fishing New Books (1988).

4) Course Manual in Fishing Technology by Latha Shenoy, CIFE, Versova, Mumbai.

) Crafts and Gear of India by Y. Shrikrishnan and Latha Shenoy – ICAR Pub.

6) Ecological Methods for Field and Laboratory Investigations by P. Michael. The Oceans By Svedrup H.V. – et.al. - Asian Pub. House.

7) Financial management by Prasanna Chandra- Seventh Edition.

8) Fish Biology by C.B.C. Srivastava – Narendra Pub. House

.9) Fish and Fisheries by Chandy – National Book Trust

10). Fish and Fisheries in India – by Jhingran V.G. – Hindustan Pub. Corporation – New Delhi.

11) Fisheries Biology, Assessment and Management by Michael King – Fishing News Publishers (1995)..

12) Fishery Science by Samtharam R. – Daya Pub. House – 1990.

13) Fisheries Bioeconomics – Theory, Modelling and Management – FAO Fisheries Technical Paper 368 – FAO, 2001.13)

14) General and Applied Ichthyology by Gupta and Gupta, S Chand Publishers.

15) Handbook of Fish Biology and Fisheries Edited By J.B. Hart and John Reynold.

16) Hand Book of Fresh Water Fishes of India by Beaven C.R. – Narendra Pub. House.

17) Introductory Oceanography by Harold Thurman – Printis Hall Pub. London – 8th Edition.

18) Marine Ecology by Tait R.B. – Oxford Press.

19) Marine Fish and Fisheries by Dr. D. V. Bal and K.V. Rao - Tata MacGraw Hill Pub. – New Delhi.

20) Prawn and Prawn Fisheries by Kurian and Sebestian.25) Project Management by Prasanna Chandra.

21) Refrigeration and air conditioning By C. P. Arora published in 1981.

22) Text Book of Fish Biology and Indian Fisheries by Dr. R. P. Parihar, Central Pub. House, Allahabad.

23) The Book of Indian Shells by Deepak Apte – Oxford Uni. Press.30) Wealth of India – Vol. IV – CSIR Pub.

S.Y. B.Sc. Semester III

Subject Zoology Paper -1 (ZOO 2303): Paper-III , Title - Practical Course

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

- **CO1** Classify the invertebrate animals belonging to Molluscs, Annelids and Arthropods.
- **CO2** Identify the different type of Fishes and its economic importance.
- **CO3** Learn how to culture and maintain the crustacean's larvae.
- **CO4** Learn different morphometric tools used in fisheries.

	PAPER CODE: ZOO2303PAPER –III: **PRACTICALS[Credit -2: No. of Practicals 12]** ***D=Demonstration, E=Experiment.A=Activity.** ***Any 10 practical's to be conducted along with 02 Activities.**
	Title of Experiment/ Practical
1)	Study and classification with reasons of the following animals: Phylum Mollusca:- *Chiton*, Snail, Bivalve, *Dentalium* and *Octopus* (D)
2)	Study and classification with reasons of the following animals: Phylum Annelida- Earthworm, Nereis, Leech (D)
3)	Study and classification with reasons of the following animals: Phylum Arthropoda:- *Peripatus*, Trilobites, King crab, Scorpion, Crab, Centipede and Millipede, Cockroach (D)
4)	Study and classification with reasons of the following animals: Phylum Echinodermata:- Sea star, Brittle star, *Holothuria*, Sea Urchin and Antedon (D)
5)	Study of permanent slides of mouthparts of the following insects : Cockroach, Mosquito, Plant bug/Bed bug, Butterfly, Honey Bee and Housefly (D)
6)	Study of Shell: *Chiton*, *Pila*, *Sepia*, *Pecten*, *Dentalium*, Study of Foot: *Chiton*,*Patella*, *Aplysia*, *Sepia*, *Octopus* and *Dentalium* (D)
7)	Culturing of Crustacean larvae and Temporary slide Preparation of various developmental stages. (E)
8)	Study of External Characters, Digestive System(D) of sea star
9)	Study of Water Vascular System and Reproductive System and larval forms of Sea star(D)
10)	Identification,study of habit, habitat and economic importance of the following forms : Rohu, Catla, Mrigal, Oyster, Bombay Duck and Mackerel. (D)
11)	Determining the age of fish by scales. (E)
12)	Calculation of fin formula of the given fish specimen. (E)
13)	Morphometric analysis of fish (E)
14)	Study of crafts and gears used in fishing industry. (D)
15)	Report submission on any five fishes of Maharashtra which are endangered/rare/threatened species.(their present status according to IUCN and measures taken for their conservation) (**A**)
16)	Study and maintenance of aquarium and ornamental fishes/aquatic animals. (**A**)

S.Y. B.Sc. Semester IV

Subject- Zoology Paper -I (ZOO 2401): Paper title Life and diversity of animals-IV [Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Understand the evolutionary perspectives of Vertebrate evolution.
CO2 Learn structure and function of vertebrate's animals.
CO3 Identify the poisonous and non poisonous snakes by using identification key.
CO4 Students are enabling to understand the different habitat and distribution of vertebrate's animals.

Unit	Details	Lectures
I	**Salient features of following classes and its subclasses** with two examples of each: 1.1 Reptilia 1.2 Aves 1.3 Mammalia	**[12]**
II	**General topics:** 2.1 Skull of Reptiles 2.2 Poisonous and non-poisonous Snakes (Two examples each) 2.3 Management of Snake bites 2.4 Migration in Birds 2.5 Beak and Feet modification in Birds 2.6 Aquatic Mammals 2.7 Egg laying Mammals	**[08]**
III	**Biology of *Scoliodon*** 3.1 Systematic position, Habit and habitat 3.2 External characters 3.3 Digestive system, food, feeding and physiology of digestion 3.4 Respiratory system 3.5 Blood vascular system 3.6 Nervous system 3.7 Sense organs 3.8 Male Urinogenital system 3.9 Female reproductive system.	**[16]**

Books-

1. Biology of Animals By Ganguly,BB.,Sinha,A.K.,Adhikari,S.,New Central Book Agency,Kolkata
2. Introduction to Amphibia By Bhamrah,MS.,Juneja,K.,Anmol Publication,Delhi
3. Life of Vertebrates By Young,JZ., III Edition,Clarendon Press,London
4. General Zoology By Goodnight and others IBH Publishing Co.
5. Life of Vertebrates By Young,JZ., III Edition, Clarendon Press,London
6. General Zoology By Goodnight and others IBH Publishing Co.
7. Textbook of Vertebrate Zoology, By Kotpal, RL.,Rastogi and Co. Meerut
8. Animal Diversity By Kershaw,DR., Redwood Burn Ltd.,Trowbridge
9. Textbook of Zoology By Parkar J. and Haswell,W.,ELBS Edition

S.Y. B.Sc. Semester IV

Subject Zoology Paper -II (ZOO2402): Paper title- Applied Zoology-II(Apiculture and Sericulture)

[Credits-2]

PAPER CODE:ZOO2402 **PAPER –II: APPLIED II (APICULTURE AND SERICULTURE)** **[Credit -2: No. of Lectures 36]**		
Course Outcomes At the end of this course, students will be able to:- ✓ The course offers career opportunity in Govt. research centers, silk boards, CBRTI,academic fields, agriculture sector banks etc. ✓ Learn the skills required in culture of different species of silkworm and honeybee. ✓ Learn the importance, extraction and marketing of different economically important by-products. ✓ Develop skills to work as consultants with in-depth and updated knowledge of the field, especially to provide guidance for the setting up of sericulture or apiculture farms.		
APICULTURE		
UNIT-1	1.1Bee keeping down the ages - Present status of Apiculture in India . 1.2 Species of honey bees(Apis dorsata, Apis indica, Apis florea and Apis mellifera). 1.3 External character ,habit habitat and life history.	**05**
UNIT-2	2.1 Bee behaviour and bee communication . 2.2 Bee colony, Castes. Natural colonies and their yield. 2.3 Types of beehives - structure - location, care and management	**05**

UNIT-3	3.1 Bee foraging: Pollen and nectar yielding plants.swarming and supersedure. 3.2Bee keeping equipments: a) Bee box (Langstroth type)b) Honey extractor c) Smoker d) Bee-veil e) Gloves f) Hive tool g) Brush h) queen excluder. 3 .3 Bee products (collection methods, composition and uses): a) Honey b) Wax c) Venom d) Propolis e) Royal jelly f) Pollen.	**04**
UNIT-4	4.1 Bee diseases , Bee pests and Bee predators. 4.2 Bee pollination and management of bee colonies for pollination .	**04**
	SERICULTURE	
UNIT-5	5.1 Introduction to Sericulture: Definition, history and present status; 5.2 Silk route Types of silkworms. 5.3 Study of different classifications 5.4 External characters of Silkworm. 5.5 Life cycle of Bombyx mori Structure of silk gland and secretion of silk	**(06)**
UNIT-6	6.1 Rearing of Silkworms Selection of mulberry variety and establishment of mulberry garden 6.2 Rearing house and rearing appliances 6.3 Disinfectants: Formalin, bleaching powder, RKO 6.4 Silkworm rearing technology: Early age and Late age rearing 6.5 Types of mountages Spinning, harvesting and storage of cocoons	**(05)**
UNIT-7	7.1 Cultivation of mulberry: a) Varieties for cultivation b) Rainfed and irrigated mulberry cultivation- Fertilize schedule, Prunning methods and leaf yield3 7.2 Harvesting of mulberry: a) Leaf plucking b) Branch cutting c) Whole shoot cutting	(04)

	7.3 Silk worm rearing: a) Varieties for rearing b) Rearing house c) Rearing techniques	
UNIT-8	8.1 Pests of silkworm 8.2 Silkworm diseases: Protozoan, viral, fungal and bacterial (any two). 8.3 Control and prevention of pests and diseases	(03)

Books-

1) Sardar Singh. Bee keeping in India
2) Cherian and Ramanathan, S. Bee keeping in South India.
3) Sharma P.L. and Singh, S.H. and Book of Bee keeping.
4) Honey - A comprehensive survey - International Bee Research Association for House - CNRC (England)
5) Roger, A. Morse, 1990. The ABC and XYZ of Bee culture, 40th edition, A.I.Root & Co., Medina, Ohio 44256. 516 pp.
6) Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
7) Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
8) Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan1972.
9) Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
10) Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
11) A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
12) Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore,

S.Y. B.Sc. Semester IV

Subject- Zoology Paper -III (ZOO2403): Paper title Practicals-IV

[Credits-2]

Course Outcomes

At the end of this course, students will be able to

CO1 Learn the taxonomic keys to classify the vertebrate's animals.
CO2 Demonstrate the Structure and function of Scoliodon.
CO3 Learn different techniques of Apiculture.
CO4 Learn different techniques of sericulture.

	PAPER CODE: ZOO2403 **PAPER –III: PRACTICALS** **Credit -2: No. of Practicals [12]** ***Any 10 practical's to be conducted along with 02 Activities.**
	Title of Experiment/ Practical
1	Study and classification with reasons of the following animals (D) Class Reptilia – *Cobra*, Garden lizard, Turtle, Rat snake, *Draco*.
2	Study and classification with reasons of the following animals (D) Class Aves – Sparrow, Crow, Parrot, Woodpecker. Class Mammals – Rabbit, Mongoose, Kangaroo.
3	Identification of Poisonous and non- poisonous snakes with the help of identification key with two examples of each (D)
4	Study of external characters and digestive system of *Scoliodon.* (D)
5	Study of Arterial System of *Scoliodon*. (D)
6	Study of brain and Sense organs of *Scoliodon* (Internal Ear, Amulla of Lorenzini) *(D)* (
7	a) Study of life cycle of Honey bee (D) b) Study of mouth parts, thoracic appendages (legs and wings) and sting apparatus of Honey bee.
8	Study of various bee keeping equipments (D) Study of: a) bee products, b) bee pests, d) bee enemies.
9	Study of life cycle of *Bombyx mori*. (D) b) Study of any five equipments in Sericulture.
10	Submission of short project report on Economics of Bee keeping . (Activity based practical) (maximum 600 words, with necessary pictures).
11	Report on bird diversity in Fergusson College campus (Activity based practical).
12	Sericulture maps: Indicating mulberry and non –mulberry belts in India. (E)
13	Preparation of pie charts: Different types of silk production in India. (E)
14	Soil analysis for pH to study the suitability for moriculture. (E)
15	Visit to Central Bee Research And Training Institute,Pune. (A)