

Anekant Education Society's
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &
COMMERCE, BARAMATI.
AUTONOMOUS INSTITUTE**



**SYLLABUS
SECOND YEAR B.Sc. ZOOLOGY
ACADEMIC YEAR 2020-2021
SEMESTER - III**

Anekant Education Society's
TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE & COMMERCE,
BARAMATI.
AUTONOMOUS

Scheme of Course Structure (CBCS) Faculty of Science

Department: Zoology

Class: S.Y.B.Sc.

Pattern: 40 (IA) + 60 (EA)

Semester	Paper Code	Title of Paper	No. of Credits
Semester III	ZOO:2101	Animal Systematics and Diversity - III	3
	ZOO:2102	Applied Zoology-I	3
	ZOO:2103	Zoology Practical-III	2
Semester IV	ZOO:2201	Animal Systematics and Diversity - IV	3
	ZOO:2202	Applied Zoology-II	3
	ZOO:2203	Zoology Practical-IV	2

IA* – Internal Assessment
EA* – External Assessment

SYLLABUS (CBCS) FOR S.Y.B.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y.B.Sc. (Semester– III)

Paper Code: ZOO: 2101

Paper: I Title of Paper: Animal Systematics and Diversity – III

Credit: 3 No. of Lectures: 48

A. Learning objectives:

- To learn basic classification and characteristics of Non- chordates.
- To learn about evolution and development of systems and animals.
- To make the students aware about conservation and sustainable use of Biodiversity.
- To emphasize on the habitat diversity of animals.

B. Learning outcomes:

- Imparts conceptual knowledge of Animals, their adaptations and associations in relation to their environment.
- Students understand the distinguishing characters and learn to identify the Non-chordate animals.
- Students acquire knowledge of economic importance of insects.
- Contributes the knowledge for conservation and sustainable use of Biodiversity

Units	TOPICS / CONTENTS	No. of Lectures
Unit 1.	Salient features and classification upto classes of the following: (any two examples from each class):	(12 L)
	1.1 Arthropoda: - Crustacea, Arachnida, Insecta, Myriapoda, Onychophora.	04
	1.2 Mollusca: - Aplacophora, Gastropoda, Scaphopoda, Pelecypoda, Cephalopoda.	04
	1.3 Echinodermata:- Asteroidea, Ophuroidea, Holothuria, Echinoidea, Crinoidea.	04
Unit 2.	General topics:	(24 L)
	2.1 Metamorphosis, Mouthparts, Mimicry, Bioluminescence and Economic importance w. r. t. Insects.	08
	2.2 Pearl formation in Bivalve, Pearl culture in India, Buoyancy modulation in Nautilus, Camouflage in Cephalopods.	08
	2.3. Autotomy and regeneration in Echinoderms, Water vascular System and locomotion in Echinoderms.	08
Unit 3.	Study of Housefly:	(12 L)
	3.1 Systematic position, Habits and habitat.	02
	3.2 External Morphology.	02
	3.3 Digestive system.	02
	3.4 Reproductive system.	02
	3.5 Nervous system and sense organs- Antenna, Compound eye and Halter.	02
	3.6 Pest status, Control measures, Economic importance.	02

REFERENCES

1. Textbook of Invertebrate Zoology, by Kotpal, RL. Rastogi and Co., Meerut.
2. Phylum Arthropoda by Kotpal, RL., Rastogi and Co. Meerut.
3. Phylum Mollusca by Kotpal, RL., Rastogi and Co. Meerut.
4. Phylum Echinodermata by Kotpal, RL., Rastogi and Co. Meerut.
5. General Zoology by Goodnight and others IBH Publishing Co.
6. Invertebrate zoology By Jordan EL., and Verma PS., S. Chand and Co., NewDelhi.
7. Life of Invertebrates by Prasad, SN, Vikas Publishing House, New Delhi.
8. Zoology by S.A. Miller and J.P. Harley –Tata McGraw Hill Co.
9. Invertebrates, Richard Brusca, Sinauer Associates, Inc., Sunderland, USA.
10. Invertebrate Zoology by Dhami and Dhami.
11. Biology of the Invertebrates, Jan A. Pechenik, McGraw Hill Education.
12. <https://www.nature.com/scitable>

SYLLABUS (CBCS) FOR S.Y.B.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y.B.Sc. (Semester– III)

Paper Code: ZOO: 2102

Paper: II

Title of Paper: Applied Zoology – I

Credit: 3

No. of Lectures: 48

Learning objectives:

- To disseminate information on economic aspects of zoology like fishery, dairy science, aquarium maintenance.
- To encourage young learners for self employment.
- To comprehend the functioning of various aspects of dairy industry
- To develop the skill of aquarium maintenance and budget allocation for setting up an aquarium fish farm.
- To study the biology of aquarium fishes, food, feeding and transportation of fishes.
- To study different indigenous and exotic cattle breeds and buffalo breeds in India.
- To develop an understanding of the different systems of breeding and various aspects dealing with housing of dairy animals.

Learning outcomes:

Students will be able to:

- Understand the concepts of fishery, Aquarium maintenance, Agricultural pests & Veterinary science.
- Classify freshwater fishes & economically important fishes.
- Describe the common Agricultural pests.
- Understand the economics & economic importance of self-employment.

Units	TOPICS / CONTENTS	No. of Lectures (21 L)
Unit 1. FISHERIES:		
	1.1 An introduction to fisheries	01
	1.2 Different types of ponds used in fishery : Nursery pond, Rearing pond, Stock pond	02
	1.3 Habit, habitat and culture methods of following freshwater forms:- a) Rohu (<i>Labeo rohita</i>) b) Catla (<i>Catla catla</i>) c) Mrigal (<i>Cirrhinus mrigala</i>)	06
	1.4 Fish preservation technique:- a) Chilling b) Freezing c) Salting d) Canning	02
	1.5 Aquarium maintenance:- a) Introduction and scope b) Exotic and Endemic species	02

c) Biology of Aquarium Fishes:-	02
i) Guppy	
ii) Molly	
iii) Gold fish	
1.6 Common characters and sexual dimorphism in Marine fishes:-	02
i) Anemone fish	
ii) Butterfly fish	
1.7 Food and feeding:-	02
i) Live fish feed	
ii) Formulated fish feed	
1.8 General Aquarium maintenance- budget for setting up an aquarium Fish Farm.	02
Unit 2. AGRICULTURAL PESTS AND THEIR CONTROL :	(13 L)
2.1. An introduction to Pest, types of pests:- (agricultural, household, stored grain, structural, veterinary, forestry and nursery)	02
2.2. Major insect pests of agricultural importance:- (Marks of identification, life cycle, nature of damage and control measures)	04
a) Jowar stem borer	
b) Rice weevil	
2.3. Non insect pest : Rats, Crabs, Snails and Birds	02
2.4. Pest control practices in brief: Physical control, Mechanical control, Chemical control, Biological control.	04
2.5. Birds as Biological Control Agents	01
Unit 3. DAIRY SCIENCE:	(14 L)
3.1. Dairy development in India:- Role of dairy development in rural economy, employment opportunities	02
3.2. Dairy Processing:- Filtration, cooling, chilling, clarification, pasteurization, freezing	03
3.3. Milk and milk products:-	03
A. Composition and Types of milk	
a) Buffalo milk and	
b) Cow milk (a1 and a2)	
c) Whole milk and toned milk	
B. Milk products:-	02
3.4. Indian Cattle breeds :-	02
a) Malvi	
b) Hariyana	
c) Deoni	
d) Red Sindhi	
e) Khillari	
3.5 Exotic breeds :-	02
a) Jersey	
b) Holstein	

REFERENCES

1. Fishes. Mary Chandy. N.B.T. India, 2005.
2. Economic Zoology, Shukla Upadhyay, Rastogi Publication, Meerut, India, 1998.
3. Fisheries Developments, K.K. Trivedi, Oxford and IBH Pub. Co.
4. Marine Fishes in India, 1990, D.V.Bal & K. Virabhdra, Tata McGraw Hill Publication.
5. Fishery Management, 1990, S.C.Agarwal, Avinash Publication House, New Dehli.
6. Entomology & Pest Management. Pedigo L.P. Prentice Hall, India 1996.
7. General & Applied Entomology, Nayar K.K. & T.N. Ananthkrishnan & B.V.Davis, Tata McGraw Hill Publication, New Dehli.
8. Insects. M.S. Mani, NBT, India, 2006.
9. Agricultural Pests: Biology & Control Measures, B.M.Deoray and T.B.Nikam, Nirali Publication, Pune, 1990.
10. Insects & Mites of Crops in India. M.R.G.K.Nair – by ICAR, New Dehli.
11. The Science of Entomology. W.S.Romosor and J.G. Stoffolano, McGraw Hill Publication, 1988.
12. Agricultural Insect Pests of India and their Control, Dennis S.Hill, Cambridge University Press.
13. Applied Entomology. Vol. I & II. K.P. Srivastava. Kalyani Publication, Ludhiyana, New Dehli.
14. Principles of Insect Pest Management. G.S. Dhaliwal and Ramesh Arora, Kalyani Publications, Ludhiyana.
15. Pest Management and Pesticides: Indian Scenario. Editor- B. Vasantaraj David, Namrutha Publications, Madras (Chennai).
16. Concepts of Insect Control. Ghosh M.R. Wiley Eastern Ltd. New Dehli.
17. Candler, W., & Kumar, N. (1998). India: The dairy revolution: The impact of dairy development in India and the World Bank's contribution. World Bank Publications.
18. Park, Y. W., & Haenlein, G. F. (Eds.). (2013). Milk and dairy products in human nutrition: production, composition and health. John Wiley & Sons.
19. Venkatasubramanian, V., Singh, A. K., & Rao, S. V. N. (2003). Dairy development in India: An appraisal of challenges and achievements. Concept Publishing Company.
20. Srivastava, J. S. M. (2008). Dairy Development In The New Millennium (The Second White Revolution). Deep and Deep Publications.

SYLLABUS (CBCS) FOR S.Y.B.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 – 2021

Class: S.Y.B.Sc. (Semester– III)

Paper Code: ZOO: 2103

Paper: II Title of Paper: ZOOLOGY PRACTICAL - III

Credit: 2 No. of Practicals: Any 10

PRACTICAL NO. / TITLE OF PRACTICAL	
1. To study the classification up to class with reasons of the following:	(D)
Phylum Arthropoda- <i>Butterfly, Scorpion.</i>	
Phylum Mollusca- <i>Pila, Octopus.</i>	
Phylum Echinodermata – <i>Sea star, Feather star.</i>	
2. Study of External Morphology of Housefly.	(D)
3. Temporary / Permanent Mountings of housefly-	(E)
a) Mouthparts, b) Antenna c) Halter	
4. Study of Digestive system of Housefly:	(D)
5. Study of Male & Female Reproductive system of Housefly.	(D)
6. Identification, Classification and study of habit, habitat and economic importance of the following:	(D)
a) Rohu	
b) Catla	
c) Mrigal	
7. Study of insect pests with respect to marks of identification, nature of damage and economic importance :	(D)
a) Jowar stem borer	
b) Rice weevil	
8. Extraction of Casein from Milk and its confirmatory test.	(E)
9. Measurement of density of milk using different samples by Lactometer	(E)
10. Preparation of Paneer/ Falooda /Ice-cream from given milk sample.	(E)
11. Aquarium maintenance –equipments required to set up –Types of filter, type of gravel, air pump, type of bulb, net, varieties of aquarium plants, varieties of fishes.	(D)
12. Submission of short project report on Economics of Fishery/Agricultural pests/Aquarium setting/Dairy (Activity based practical) (with necessary pictures).	(E)
13. Compulsory visit to Biodiversity spot/Fishery farm/Dairy farm /Aquaculture and submit report of the same.	(E)

***D=Demonstration, E=Experiment.**

- **Practical No. 13 is Compulsory, from remaining any 9 practicals be conducted.**
- **Maintenance of good laboratory record (Journal) along with visit report by the student is mandatory.**

REFERENCES

1. Practical Zoology of Invertebrates by S. S. Lal.
2. Practical Zoology of Vertebrates by S. S. Lal.
3. Practical Zoology Vol-3 by N Arumugamm and A. Mani.
4. Practical Zoology of Invertebrates by Jordan and Verma.
5. Practical Zoology of Vertebrates by Jordan and Verma.
6. Practical Zoology of Cell Biology by S. S. Lal.
7. Genetics- Molecular Approach, 3rd Ed. by Peter J. Russell, Pearson.

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**SYLLABUS
SECOND YEAR B.Sc. ZOOLOGY
ACADEMIC YEAR 2020-2021
SEMESTER - IV**

SYLLABUS (CBCS) FOR S.Y.B.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y.B.Sc. (Semester– IV)

Paper Code: ZOO: 2201

Paper: I Title of Paper: Animal Systematics and Diversity – IV

Credit: 3 No. of Lectures: 48

A. Learning objectives:

- To learn basic classification and characteristics of Chordates.
- To learn about evolution and development of systems and animals.
- To make the students aware about conservation and sustainable use of Biodiversity.
- To emphasize on the habitat diversity of animals.

B. Learning outcomes:

- Imparts conceptual knowledge of Animals, their adaptations and associations in relation to their environment.
- Students understand the distinguishing characters of and learn to identify the Chordate animals.
- Contributes the knowledge for conservation and sustainable use of Biodiversity.
- Imparts conceptual knowledge of Animals, their adaptations and associations in relation to their environment.

Units	TOPICS / CONTENTS	No. of Lectures
Unit 1.	General characters and classification of following classes and their sub-classes with two examples of each:	(12 L)
	1.1. Reptilia	04
	1.2. Aves	04
	1.3. Mammalia	04
Unit 2.	General topics:	(16 L)
	2.1. Desert adaptations in reptiles, poison apparatus, snake venom, Antivenin :(cure of snake bite), First aid, treatment of snake bite.	06
	2.2. Bird migration, structure of feathers, Birds as flying machines, Mechanism of flight.	05
	2.3. Egg laying mammals, Aquatic mammals, Flying mammals.	05
Unit 3.	Study of <i>Labeo rohita</i>:	(20 L)
	3.1. Systematic position, Habit and habitat	02
	3.2. External characters and sexual dimorphism	02
	3.3. Digestive system, food, feeding and physiology of digestion	04
	3.4. Circulatory & Respiratory system in brief.	04
	3.5. Nervous system.	02

3.6. Sense organs	03
3.7. Reproductive systems (male & female)	03

REFERENCES

1. Animal Diversity by Kershaw, DR., Redwood Burn Ltd., Trowbridge
2. Textbook of Zoology by Parker J. and Haswell, W., ELBS Edition
3. Functional Organization of chordates (part I and II) by Nigam HC. And Sobti, R., S. Chand and Co., New Delhi
4. Textbook of Vertebrate Zoology by Prasad, SN., Kashyap, V., New Age India Publishers, New Delhi
5. Modern Textbook of Zoology, Vertebrates by Kotpal, RL., Rastogi and Co. Meerut
6. Biology of Animals by Ganguly, BB., Sinha, A.K., Adhikari, S., New Central Book Agency, Kolkata
7. General Zoology by Goodnight and others IBH Publishing Co.
8. Life of Vertebrates by Young, JZ, III Edition, Clarendon Press, London.
9. Animal Diversity by Kershaw, DR., Redwood Burn Ltd., Trowbridge
10. Textbook of Zoology by Vidyarthi, Agrasia Publishers, Agra.
11. Chordate Zoology by Jordan EL., and Verma PS., S. Chand and Co., New Delhi.
12. Functional Organization of chordates (part I and II) by Nigam HC. And Sobti, R., S. Chand and Co., New Delhi.
13. This is Biology: The Science of Living world, Mayr, M. Universities Press Ltd.
14. J.R.B. Alfred and Ramakrishna Collection, Preservation and Identification of animals. Zoological Survey of India Publications.

SYLLABUS (CBCS) FOR S.Y.B.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y.B.Sc. (Semester– IV)

Paper Code: ZOO: 2202

Paper: II Title of Paper: Applied Zoology-II

Credit: 3 No. of Lectures: 48

Learning objectives:

- To disseminate information on economic aspects of zoology like apiculture, sericulture.
- To encourage young learners for self employment.
- To comprehend the functioning of apiculture sericulture industry and its scope in India.
- To study the honey bee species and bee products
- To study the varieties of silk-worms and host plants.
- To critically study the life history and rearing of *Bombyx mori*, harvesting, processing of cocoon, production of silk and diseases afflicting silk-worms

Learning outcomes:

Students will be able to-

- Identify different honey bee & silkworm species.
- Explain the tools & techniques used in apiculture & sericulture.
- Illustrate the diseases of honey bee & silkworm.
- Understand the economic importance of apiculture & sericulture.

Units	TOPICS / CONTENTS	No. of Lectures
Unit 1. Apiculture :		(24 L)
	1.1. An introduction to Apiculture, Study of habit, habitat and nesting behavior of <i>Apis dorsata</i> , <i>Apis indica</i> , <i>Apis florae</i> <i>Apis mellifera</i> And <i>Trigona species</i>	03
	1.2. Advantages and disadvantages of traditional and modern methods of apiculture.	02
	1.3. Life cycle, Colony organization and division of labour, Polymorphism	02
	1.4. Bee behaviour and bee communication.	03
	1.5. Bee keeping equipments : a) Bee box (Langstroth type) b) Honey extractor c) Smoker d) Bee-veil e) Gloves f) Hive tool g) Bee Brush h) Queen excluder	02
	1.6. Bee keeping and seasonal management.	02
	1.7. Bee products (collection methods, composition and uses: a) Honey b) Wax c) Bee Venom d) Propolis e) Royal jelly f) Pollen grains	04
	1.8. Diseases and enemies of Bees: a) Bee diseases – Protozoan, Bacterial, Fungal – with two examples. b) Bee pests – Wax moth (Greater and Lesser), Wax beetle. c) Bee Enemies – Bee eater, King crow, Wasp, Lizard, Bear, Man.	04
	1.9. Bee pollination, Selection of flora and bees for apiculture.	02
Unit 2. Sericulture :		(24 L)

2.1 An Introduction and its scope , Study of different types of silk moths, their distribution and varieties of silk produced by Mulberry, Tassar, Eri and Muga silk worms in India.	03
2.2 External morphology and life cycle of <i>Bombyx mori</i> .	02
2.3 Cultivation of mulberry (moriculture): a) Varieties for cultivation, b) Rainfed and irrigated mulberry cultivation – Fertilize schedule, Prunning.	04
2.4 Harvesting of mulberry: a) Leaf plucking b) Branch cutting c) Whole shoot cutting.	02
2.5 Quality of silk, factors influencing the quality of silk, market value, commercial aspects	03
2.6 Silk worm rearing: a) Types of rearing b) Rearing house c) Rearing techniques d) Important diseases and pests.	05
2.7 Post harvest processing of cocoons: a) Harvesting and Preparation of cocoons for marketing b) Stiffling, Sorting, Storage, Deflossing and Riddling c) Cocoon cooking, Reeling and Rereeling, Washing and Polishing.	03
2.8 Prospects of Sericulture in India	02

REFERENCES

1. Destructive and useful Insects, their habit and Control, 1973. C.L.Metcalf and W. p. Flint, Tata McGraw Hill Publications, New Dehli.
2. A Text Book Of Entomology, 1974. V.K. Mathur and K.D. Upadhayay, Goel Printing Press, Barani.
3. Imm's Text Book of Entomology, Vol I & II, Richard and Owen.
4. Biology of Insects, 1992. S.C. Saxena. Oxford and IBH Publishing Co., New Dehli. Bombay, Calcutta.
5. Bee and Bee Keeping, 1978, Roger A. Morse, Conell University Press, London.
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12. Bee and Bee Keeping- Roger A. Morse, Conell University Press London

SYLLABUS (CBCS) FOR S.Y.B.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y.B.Sc. (Semester– IV)

Paper Code: ZOO: 2203

Paper: III Title of Paper: ZOOLOGY PRACTICAL – IV

Credit: 2 No. of Practicals: Any 10

PRACTICAL NO. / TITLE OF PRACTICAL

- 1. To study the classification with reasons the following animals: (D)**
Class: Reptilia- Cobra, Garden lizard, Turtle, Rat snake, Draco
- 2. To study the classification with reasons the following animals: (D)**
Class: Aves- Sparrow, Crow, Wood pecker, Parrot
Class: Mammalia- Rabbit, Mongoose, Kangaroo
- 3. Study of External characters and digestive system of *Labeo rohita* (E)**
- 4. Study of Brain of *Labeo rohita*: (E)**
- 5. Temporary preparation of- a) Cycloid scales from *Labeo rohita* b) Eye ball muscles (E)**
- 6. Study of life cycle of Honey bee (D)**
- 7. Study of mouth parts, thoracic appendages (legs and wings) (E)**
and sting apparatus of Honey bee
- 8. Study of various bee keeping equipments (Any five equipments): (D)**
- 9. Study of: a) bee products, b) bee pests, d) bee enemies (D)**
- 10. a) Study of life cycle of *Bombyx mori*. (D)**
b) Study of any five equipments in Sericulture.
- 11. Submission of short project report on Economics of Bee keeping/sericulture (E)**
(Activity based practical) (With necessary pictures).
- 12. Compulsory visit to biodiversity spot/sea shore/apiculture/sericulture farm and submit (E)**
report of the same.

***D=Demonstration, E=Experiment.**

- Practical No. 12 is Compulsory, from remaining any 9 practicals be conducted.**
- Maintenance of good laboratory record (Journal) along with visit report by the student is mandatory.**

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