

Khandesh College Education Society's
Moolji Jaitha College, Jalgaon
An "Autonomous College" Affiliated to
KBC North Maharashtra University, Jalgaon



SYLLABUS

ZOOLOGY
S.Y.B. Sc.
(Semester III and IV)

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2020-21]

Course Structure: S. Y. B. Sc (Zoology)

Duration: The duration of B.Sc. (Zoology) degree program shall be three years.

Term / Semester	Course Module	Subject Code	Title of Paper	Credit	Hours per Week
III	DSC	ZOO-231	Animal diversity – III	2	2
	DSC	ZOO-232	Medical diagnostics	2	2
	DSC	ZOO-233	Practical based on ZOO-231 and 232	2	4
	SEC	ZOO-230	Parasitology	2	2
IV	DSC	ZOO-241	Animal diversity – IV	2	2
	DSC	ZOO-242	Applied zoology	2	2
	DSC	ZOO-243	Practical based on ZOO-241 and 242	2	4
	SEC	ZOO-240	Apiculture	2	2

DSC : Discipline Specific Elective Core Course

SEC : Skill Enhancement Course

ZOO- YSC : Zoology (Y-year; S-Semester; C-Course number)

Examination Pattern for S. Y. B. Sc.

Examination	Marks
External Marks	40
Internal Marks	10
Total Marks	50

S.Y. B.Sc. (Zoology): Semester-III
ZOO-231: Animal Diversity – III

Total Hours: 30

Credits: 2

Course objectives:

- Students will be able to identify and define an invertebrate
- Students will be able to classify animals as an invertebrate
- To provide the students with knowledge of classification and Economic importance.
- Enable students to understand external and internal morphology.
- Identify common species available in and around their region using morphological keys.

Course outcomes:

Student will be able to

- Learner can differentiate morphological features of the invertebrates.
- Learner can classify an invertebrate
- Learn aspects of the internal body organization using relevant conventions, terminology.
- Identifies, describes and evaluates the social and economic importance Invertebrate
- Develop an understanding of the role of taxonomy in identification of Invertebrate.

Unit I: Animal Type Study: Asterias –A Sea star w. r. t. following **6h**

- Introduction, Systematic Position
- Habit and Habitat {Ecology}
- External Characters - Shape, Size and Colour, Symmetry
- Oral Surface, Aboral Surface
- Pedicellariae- Straight and Cross type
- Body Wall, Endoskeleton, Coelom

Unit II: Digestive System **6h**

- Alimentary canal
- Food and Feeding Mechanism
- Digestion, Absorption and Egestion

Unit III: Locomotion **6h**

- Water Vascular or Ambulacral System
- Structure, Function and Significance

Unit IV: Circulatory System **4h**

- Haemal and Perihemal System

Unit V: Respiratory System **2h**

Unit VI: Excretion **1h**

Unit VII: Nervous System **6h**

- Superficial or ectoneural nervous system
- Hyponeural nervous system
- Aboral or coelomic nervous system
- Visceral nervous system
- Sense organs- Neurosensory cells, Eyes

Unit VIII: Reproductive System **8h**

- Gonads
- Life History and Development- Fertilization, Embryogeny

- Structure of Dipleurula larva or Early bipinnaria, Bipinnaria larva and Brachiolaria larva Metamorphosis, Regeneration and Autotomy
- Unit IX: Arthropoda** **7h**
- General character, habit, habitat and distribution.
 - Classification up to classes and Economic importance
- Unit X: Mollusca** **7h**
- General characters, habit, habitat and distribution.
 - Classification up to classes and Economic importance
- Unit XI: Echinodermata** **7h**
- General characters, habit, habitat and distribution.
 - Classification up to classes and Economic importance.

References:

1. Marshall and William, (1972): A Test Book of Zoology - Invertebrates, Vol- I, London : Macmillan.
2. Hymen L.H. (1992): The Invertebrate- McGraw Hill., Published by International Books & Period, New Delhi
3. Barnes R.O. W.B. (1970): The Invertebrates – Saunders & Co., Oxford University Press
4. Kotpal R.L. (2018): The Invertebrates – Rastogi Publication Meerut
5. Prasad J. N. ()1980: Life of Invertebrates – Vikas Publishing House New Delhi
6. Kotpal R.L. (2018): Modern Test Book of Zoology- Rastogi Publication
7. Vidyarthi R.D. (2005): A Test Book of Zoology – S Chand & Company Pvt Ltd.
8. Dhami and Dhami (1979): A Test Book Invertebrate Zoology – R. Chand & Company

S.Y. B.Sc. (Zoology): Semester-III

ZOO-232: Medical Diagnostics

Total Hours: 30

Credits: 2

Course objectives:

- To know about the scope and importance of medical diagnostic.
- To study various diagnostic test of diseases.
- To know about the method of screening and prognosis.

Course outcomes:

Student will be able to

- Understand the method of disease diagnosis.
- Explain the method of screening.
- Learn various diagnostic techniques.

Unit I: Introduction to Medical Diagnostics and its Importance **2h**

Unit II: Diagnostics Methods Used for Analysis of Blood **10h**

- Blood composition
- Preparation of blood smear
- Differential Leucocyte Count (D.L.C) using Leishman's stain
- Platelet count using haemocytometer

- Erythrocyte Sedimentary Rate (E.S.R)
 - Packed Cell Volume (P.C.V.)
- Unit III: Diagnostic Methods Used for Urine Analysis** **6h**
- Urine Analysis: Physical characteristics, normal and abnormal constituents; Benedict's test and Dipstick test.
- Unit IV: Non-infectious Diseases** **6h**
- Causes, types, symptoms, complications,
 - Diagnosis and prevention of Diabetes (Type I and Type II),
 - Hypertension (Primary and secondary),
 - Testing of blood glucose using Glucometer/ diagnostic kit
- Unit V: Infectious Diseases** **3h**
- Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis
- Unit VI: Tumours** **3h**
- Types – Benign / Malignant Detection and metastasis
 - Medical imaging with reference to tumours: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs)

References:

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. (2003). Textbook of Medical Laboratory Technology Edition, Bhalani Publishing House
- Guyton A.C. and Hall J.E. (1956). Textbook of Medical Physiology, Saunders
- Robbins and Cortan, (1971). Pathologic Basis of Disease, VIII Edition, Saunders
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

S.Y. B.Sc. (Zoology): Semester-III
ZOO-233: Practical Based on ZOO-231 and 232

Total Hours: 60

Credits: 2

Course objectives:

- To understand identification and classification of Invertebrate
- Learn aspects of the internal body organization using relevant conventions, terminology.
- To know the economic importance animal diversity.
- To study various diagnostic test of diseases.
- To know about the method of screening and prognosis.

Course outcomes:

Student will be able to

- Understand external and internal anatomy and morphology.
- To develop laboratory skills in the students regarding identification and classification of Invertebrate
- Learn to Identify, describes and evaluates the social and economic importance Invertebrate
- Understand the method of disease diagnosis.
- Explain the method of screening.
- Learn various diagnostic techniques

ZOO 233 – Practicals corresponding to ZOO 231

To study the following with the help of charts/ models/ diagrams/ specimens:

1. Study of External character [Oral and Aboral View] of Sea star.
2. Study of the Digestive System of Sea star.
3. Study of Water vascular system of sea star.
4. Systematic position, habit and habitat of at least one animal of each class of the phyla. (Arthropoda, Mollusca, And Echinodermata)
5. Economic importance of any two animals of each phylum.
6. Study of Modification of foot in Mollusca.
7. Identification of mosquito species.
8. Mounting of Mouth Parts of Grasshopper /Cockroach / Anopheles etc.
9. Visit to any Ecosystem.

ZOO 233 – Practicals corresponding to ZOO 232

1. Study Differential Leucocyte Count (D.L.C) using
2. haemocytometer and Leishman's stain. (E)
3. Estimation of Erythrocyte Sedimentary Rate (E.S.R). (E)
4. Determination Packed Cell Volume (P.C.V.). (E) Qualitative analysis of Urine w.r.t. Physical characteristics, normal and abnormal constituents. (E)
5. Study of Non-infectious and Infectious Diseases: Diabetes, Hypertension, Tuberculosis and Hepatitis. (D)
6. Testing of blood glucose using Glucometer/ diagnostic kit. (E)
7. Study of metastasis and Medical imaging with reference to tumours: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs). (D)

References

- Verma, P. S., 2000, A Manual of Practical Zoology: Chordates. S. Chand Publishing, New Delhi
- Marshall, A. M., and Hurst, C. H., 1888, A junior course of practical Zoology, Published by Smith, Elder, London (1892)
- Wallis, C. J., 2015, Practical Zoology: For advanced level and intermediate students, Elsevier, India Division.

S.Y. B.Sc. (Zoology): Semester-III ZOO-230: Parasitology

Total Hours: 30

Credits: 2

Course objectives:

- To study different kinds of Parasites
- To know Pathogenicity, Prevention, Control measures and Treatment

Course outcomes:

Student will be able to

- Learner would understand the concepts of parasitism and its relationship in the environment
- Learner would understand the life cycle of specific parasites, the symptoms of the disease and its treatment

Unit I: Introduction, Scope and Importance of Parasitology	2h
<ul style="list-style-type: none"> ● Definition –Host, Parasite and vector ● Animal association -Intraspecific ● Interspecific –Mutualism, Commensalism, Parasitism 	
Unit II: Study of types of Parasites	5h
<ul style="list-style-type: none"> ● According to habitat –Ecto parasites and Endo parasites ● Degree of parasitism- Temporary, Permanent, Facultative and Obligatory ● Effect of parasite on host 	
Unit III: Types of Hosts	5h
<ul style="list-style-type: none"> ● Definitive, Intermediate, Paratenic Reservoir and Accidental host. ● Host specificity –Definition and characters ● Host reaction to parasites – (Resistance, Compatibility, Immunity, Cellular reactions, Tissue reactions) 	
Unit IV: Study of the following Endo parasites with reference to Systematic Position Habit, Habitat, Morphology, Life cycle, Pathogenicity Prevention, Control measures and Treatment	10h
<ul style="list-style-type: none"> ● <i>Entamoeba histolytica</i> ● <i>Plasmodium vivax</i> ● <i>Fasciola hepatica</i> (instead this, add <i>Ascaris lumbricoides</i>) ● <i>Taenia solium</i> 10 	
Unit V: Study of the following Ecto parasite with reference to Morphology, Life cycle, Pathogenicity, Control measures and Treatment	8h
<ul style="list-style-type: none"> ● <i>Pediculus humanus capitis</i> (Head louse) ● <i>Sarcoptes Scabiei</i> (Mite) ● <i>Dermacentor Variabilis</i> (Tick) 	
References	
<ul style="list-style-type: none"> ● Cheng T.C Philadelphia (1964) The biology of animal parasites W.B.Saunders Company publisher,London ● Pranabeswar Chakraborty (2010) Textbook of Medical Parasitology New Central Book Agency,Delhi. ● C.K.Jayaram Paniker (2002)Text book of Medical Parasitology - Jaypee Brothers publisher, New Delhi. ● Chatterjee K.D(2005) Parasitology Protozoology & Helminthology- CBS Publishers & Distributors,New Delhi. 	

S.Y. B.Sc. (Zoology): Semester-IV
ZOO-241: Animal Diversity – IV

Total Hours: 30

Credits: 2

Course objectives:

- To take learners through a captivating journey of hoarded wealth of marvelous animal world.

Course outcomes:

Student will be able to

- Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of

Zoology.

1. Study and understand various system adaptations in higher Chordates
2. To provide thorough knowledge about various animal sciences from primitive to highly evolved animal groups
3. To make the students aware about conservation and sustainable use of biodiversity

Unit I: Reptile

5h

- General characters and classification up to subclass, Poisonous and nonpoisonous snakes, Poison Apparatus in snakes and biting mechanism, Effect of different Snake bite, First-aid Treatment of Snake Bite

Unit II: Aves

5h

- General characters and classification up to subclass,
- Archaeopteryx and its significance
- Aerial adaptation and Migration in birds
- Types of beaks and feet in birds.
- Economic importance of birds

Unit III: Mammals

4h

- General characters and classification up to subclass
- Adaptive radiation in mammals
- Adaptive features in desert, Aerial and aquatic Mammals

Unit IV: Animal Type study: Fowl

3h

- Systematic position, Habit, Habitat and distribution.
- External morphology and sexual dimorphism, Division of body
- Economic importance of Fowl

Unit V: Study of systems of Fowl with respect to

10h

- Digestive system with feeding and digestion mechanism.
- Respiratory system with Mechanism of respiration.
- Circulatory system- Heart – External and internal structure, working of heart. Arterial system, Venous system, Course of blood circulation.
- Nervous system- Central nervous system (Brain and spinal cord), Cranial nerves, Sense organ- Eye.
- Male urinogenital system, Female excretory and Reproductive system. Copulation and Fertilization.

Unit VI: Conservation of species

3h

- Threatened and endangered species-causes and importance

References

1. Prasad, S. N., & Kashyap, V. (1989). A Textbook of Vertebrate Zoology. New Age International.
2. Young, J. Z. (1950). The life of Vertebrates. The life of vertebrates.
3. Kotpal, R. L. (2010). Modern text book of Zoology: vertebrates. Rastogi Publications.
4. Bharah H. S. and Juneja K. (2002). A Text Book of Chordates. Anmol Publisher
5. Jordan, E. L., & Verma, P. S. (1965). Chordate Zoology. S. Chand.
6. Arumugam N., Thangamani A., Prasanna kumar S. and Narayanan L. M. (2013) A Text Book of Chordates. Saras Publication, Nagercoil.

S.Y. B.Sc. (Zoology): Semester-IV
ZOO-242: Applied Zoology
(Vermiculture, Poultry and Pearl Culture)

Total Hours: 30

Credits: 2

Course objectives:

- To provide a strong foundation and motivation for applying fundamental concepts of **Applied Zoology** in basic research to meet global challenges.
- To make students to acquire more practical knowledge through visit to Research Institutions, Industries, Universities etc.

Course outcomes:

Student will be able to

- Understands concepts of Vermiculture, Poultry and Pearl Culture
- Learn the basic principles involved in the culture and breeding of common Vermiculture, Poultry and Pearl Culture
- Enable to co-op with market and self-employment

Unit I: Vermiculture

20h

- Vermiculture: Introduction and scope
- Species of earthworm (Classification): *Eisenia foetida* (Savigny), *Eudrilus eugeniae* (Kinb.)
- Establishment of vermicomposting and Vermiwash unit:
 - Biologically degradable material: –Agricultural waste and agro-industry waste
 - Feeding vermicomposting materials: - Materials which should not feed to earthworm, Quantity of material eat by earthworm; Feeding procedure
 - Vermicomposting types: Small scale or Indoor vermicomposting, Large scale or outdoor vermicomposting
 - Physical requirement for vermicomposting: Air; moisture and temperature
 - Construction of vermiculture unit: Bedding material; steps of preparation of vermin bed – KISS (Keep It simple and Save) Plan.
 - Set up of vermiwash unit
- Factor affecting growth of earthworm: Earthworm and Insect; Tilling and Earthworm population Earthworm and Come Drowning.
- Earthworm's Parasites and predators - Mites, Leech, Nematodes, Ciliates, Sporozoans.
- Economic importance of vermicompost and vermiwash

Unit II: Poultry

20h

- Poultry: Introduction and Scope
- Species of Hens (Classification): Asil (Aseel), Brahma
- Housing and equipment of poultry: Feeders; Heaters or Brooders; Incubator with Controller; Egg Tray; Ventilation Fan; Laying Nest; Egg Washer; Water Pots and Drinkers; Cages and Coops; Dressing Machine; Beak trimmer; Sprayer
- Poultry nutrition; Poultry diseases; Poultry care management
- Economic importance of egg, flesh, bones, manure

Unit III: Pearl culture

20h

- Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

- Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.
- Pearl oyster culture: Techniques of pearl oyster culture (Freshwater and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, underwater platforms, mother oyster culture / Collection of oysters, rearing of oysters, Environmental parameters. Pearl Oyster surgery (Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery), Post-operative culture, harvesting of pearl, clearing of pearl.
- Diseases and Predators of Pearl oysters.
- Present status, prospects and problems of pearl industry in India.

References

- Singh R. A., 2013, Poultry production, Kalyani publishers, New Delhi.
- Banerjee G. C., 2018, Animal Husbandry, Oxford and IBH publishing Co., New Delhi
- Manju Yadav, 2010, Economic Zoology, Discovery publishing house, New Delhi
- Manju Yadav, 2010, Applied Entomology, Discovery publishing house, New Delhi -
- Shukla G.S. and Upadhyay V.B., 2017, Economic Zoology-, Rastogi publication, Meerut
- Srivastava P. D. and Pant N. C., 2009, Economic Zoology vol. I and II, Commercial Publication Bureau, New Delhi

S.Y. B.Sc. (Zoology): Semester-IV **ZOO-243: Practical based on ZOO-241 and ZOO- 242**

Total Hours: 60

Credits: 2

Course objectives:

- To take learners through a captivating journey of hoarded wealth of marvelous animal world.
- To provide a strong foundation and motivation for applying fundamental concepts of **Applied Zoology** in basic research to meet global challenges.
- To make students to acquire more practical knowledge through visit to research institutions, industries, Universities etc.

Course outcomes:

Student will be able to

- Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of Zoology.
- Study and understand various system adaptations in higher Chordates
- To provide thorough knowledge about various animal sciences from primitive to highly evolved animal groups
- To make the students aware about conservation and sustainable use of biodiversity
- Understands concepts of Vermiculture, Poultry and Pearl Culture
- Learn the basic principles involved in the culture and breeding of common Vermiculture, Poultry and Pearl Culture
- Enable to co-op with market and self-employment

Practical corresponding to ZOO-241

- 1) Study of the following specimens D*
 - ❖ Reptilia: Chelone, Chameleon, Crocodile, Varanus
 - ❖ Aves: Duck, Parrot, Wood pecker, King fisher
 - ❖ Mammals: Kangaroo, Scaly ant eater, Whale, Bat, Squirrel
- 2) Study of Poisonous and nonpoisonous snakes D*
- 3) Study of beaks and feet in birds D*
- 4) Systematic position and External characters of Fowl D*
- 5) Study of Digestive system of Fowl D*
- 6) Study of Male and Female Reproductive system of Fowl D*
- 7) Study of Excretory system of Fowl D*
- 8) Study of Nervous system of Fowl D*
- 9) Study of Egg of Fowl E

*Study of animals with the help of models / charts / pictures / simulation. An “animal album” containing photographs, cut outs, with appropriate write up about the above-mentioned taxa. Different taxa / topics may be given to different sets of students for this purpose

Practical corresponding to ZOO- 242

- 1) Identification of any two species of earthworm (Ext. Morphology).
- 2) Identify and describe - a) Cocoon b) Vermicast.
- 3) Establishment of vermiwash unit.
- 4) Study of external morphology of Indian fowl and sexual dimorphism.
- 5) Study of poultry breeds: White Plymouth Rock, White Leghorn, White cornish, Brahma, Aseel.
- 6) Study of poultry equipment. Study of poultry equipment (Feeders; Heaters or Brooders; Incubator with Controller; Egg Tray; Egg Washer; Water Pots and Drinkers; Beak trimmer; Sprayer)
- 7) Morphology and anatomy of Pearl oyster. Life cycle of pearl oyster
- 8) Diseases and Predators of Pearl oysters
- 9) Embedding beads in suitable mollusc (Such as Unio sp; Katelysia sp.) under sterilized conditions for pearl culture.

References

- Verma, P. S., 2000, A Manual of Practical Zoology: Chordates. S. Chand Publishing, New Delhi
- Marshall, A. M., and Hurst, C. H., 1888, A junior course of practical Zoology, Published by Smith, Elder, London (1892)
- Wallis, C. J., 2015, Practical Zoology: For advanced level and intermediate students, Elsevier, India Division.

S.Y. B.Sc. (Zoology): Semester-IV ZOO-240: Apiculture

Total Hours: 30

Credits: 2

Course objectives:

- To increase the knowledge of bees and bee culture;
- To improve the standard of beekeeping amongst amateur beekeepers;
- To assist in the study of subjects allied and relevant to apiculture;
- To foster intelligent observation and good practical handling of bees;

Course outcomes:

Student will be able to

- Understand bee biology and behaviour: Types of Bees, Life cycle
- Handle beekeeping systems and beekeeping equipments: Bee Keeping Systems/Hives, Installation of Hives, Tools
- Beehive Management: Colony Management etc
- Manage insects, diseases and nuisances in beehive:
- Harvest, process and market the produce: Honey and other byproducts, Method of Harvesting, time of harvesting, tools and equipments required, Processing of products, marketing etc

Unit I: Biology of Bees	4h
● History, Classification and Biology of Honey Bees, Social Organization of Bee Colony	
Unit II: Rearing of Bees	12h
● Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture, Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)	
Unit III: Diseases and Enemies	5h
● Bee Diseases and Enemies Control and Preventive measures	
Unit IV: Bee Economy	4h
● Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis, Pollen, etc)	
Unit V: Entrepreneurship in Apiculture	5h
● Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens	

References

- Prost, P. J., 1962, Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., 1980, Apiculture, ICAR Publication.
- Singh S., 1962, Beekeeping in India, Indian council of Agricultural Research, New Delhi.
- Pierre Jean-Prost and Paul Medori, Apiculture, 1994, (6th edition, reviewed and updated), Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Calcutta, Bombay.
- Phillips E. F., 2003, Beekeeping, Published by Agrobios (India), Jodhpur
- Abrol D. P., 2010, Bees and Beekeeping in India, Kalyani Publishers, Ludhiana, New Delhi, Hyderabad, Chennai, Calcutta.
- Mohammad Naim, 2006, Bee keeping for pleasure and profit, Kalyani Publishers, Ludhiana.
- Nikam T. B. and Deoray B. M., 1990, Bee-Keeping and Man, Nirali Prakashan, Pune.
- Manju Yadav, 2010, Applied Entomology, Discovery publishing house, New Delhi.
- Srivastava K. P., 2013, A text book of Applied Entomology - Vol. II, Kalyani Publishers, Ludhiana, New Delhi, Hyderabad, Chennai, Calcutta.
- Shukla G. S. and Upadhyay V. B., 2009, Economic Zoology, 4th Edition, Rastogi Publication, Meerut.
- Sonawane S. M., Jaiswal D. P., Shelke A. D. Mahajan N. G. and Manojkumar Chopda, 2019, ZOO-304, Sem III, Apiculture (Skill Enhancement Course), A Textbook at S. Y. B. Sc. level, as per Kavayitri Bahinabai Chaudhari North

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