

**NORTH MAHARASHTRA UNIVERSITY,  
JALGAON**



(NAAC Re-Accredited)  
"A" Grade

**FACULTY OF SCIENCE**

**SYLLABUS FOR**

**S.Y.B.Sc.  
(ZOOLOGY)**

**To Be Implemented From  
Academic Year 2016-17**

**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**

Semester	Paper	Paper code	Course Title	Marks	
				U.A.	C.A.
I	I	ZOO 231	Non-Chordates - II	60	40
	II	ZOO 232	Medical Zoology	60	40
	III	ZOO 233	Practical	60	40
II	I	ZOO 241	Chordates – II	60	40
	II	ZOO 242	Applied Zoology	60	40
	III	ZOO 243	Practical	60	40

**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**  
**Sem – I Paper –I – ZOO 231: Non Chordates –II**

Unit	Topic	Period	Marks
<b>Animal Type Study: Asterias –A Sea star w.r.t. following</b>			
<b>1</b>	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	6	<b>6</b>
<b>2</b>	Digestive System – Alimentary canal Food and Feeding Mechanism Digestion, Absorption and Egestion	6	<b>6</b>
<b>3</b>	Locomotion; Water Vascular or Ambulacral System Structure, Function and Significance,	5	<b>5</b>
<b>4</b>	Circulatory System – Haemal and Perahaemal System	3	<b>3</b>
<b>5</b>	Respiratory System	2	<b>2</b>
<b>6</b>	Excretion	1	<b>1</b>
<b>7</b>	Nervous System- A] Superficial or ectoneural nervous system B] Hyponeural nervous system C] Aboral or coelomic nervous system D] Visceral nervous system Sense organs- Neurosensory cells, Eyes	6	<b>6</b>
<b>8</b>	Reproductive System- Gonads Life History and Development- Fertilization, Embryogeny Structure of Dipleurula larva or Early bipinnaria, Bipinnaria larva and Brachiolaria larva Metamorphosis, Regeneration and Autotomy	7	<b>7</b>
<b>General Topics</b>			
<b>9</b>	<b>i] Mouth parts in Insects</b> a] Biting and Chewing type b] Piercing and Sucking type c] Siphoning type d] Chewing and Lapping type	6	<b>6</b>
<b>10</b>	<b>ii] Canal System in Sponges</b> a) Ascon type, b) Sycon type, c) Leucon type and d) Rhagon type	6	<b>6</b>
<b>11</b>	<b>iii] Locomotion in Protozoa</b> Locomotary organelles- Pseudopodia, Flagella & Cilia Amoeboid movement, Flagellar movement, Ciliary movement	6	<b>6</b>
<b>12</b>	<b>iv] Foot in Mollusca</b> Amphineura, Scaphopoda, Gastropoda, Pelecypoda and Cephalopoda	6	<b>6</b>
<b>Total</b>		<b>60</b>	<b>60</b>

## **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]
2. Study of Digestive System of Sea star
3. Study of Water vascular system of sea star
4. Study of various Canal System in Sponges
5. Study of Locomotion in Protozoa
6. Study of Modification of foot in Mollusca
7. Mounting of Mouth Parts of Grasshopper /Cockroach / Anopheles etc
8. Visit to any Ecosystem

### **Suggested Books**

1. A Test Book of Zoology - Invertebrates, Vol- I, Marshall and William
2. The Invertebrate- Hymen L.H. McGraw Hill
3. The Invertebrates – Barnes R.O. W.B. Saunders & Co
4. The Invertebrates – Kotpal R.L. Rastogi Publication Meerut
5. Life of Invertebrates – J. N. Prasad Vikas Publishing House New Delhi
6. Modern Test Book of Zoology- Kotpal R.L. Rastogi Publication
7. A Test Book of Zoology – R.D.Vidyarthi
8. A Test Book Invertebrate Zoology – Dhami and Dhami

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**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**  
**Sem – I Paper –II – ZOO 232: Medical Zoology**

Units	Topic	Periods	Marks
1	Introduction, Scope and branches of Medical Zoology: Medical Protozoology, Medical helminthology, Medical Entomology, Forensic Entomology.	3	3
2	<b>Parasites and Host</b> <b>2.1</b> Definition <b>2.2</b> Types of parasites <b>2.2.1</b> Ectoparasite <b>2.2.2</b> Endoparasite - Gut parasite, Haemoparasites, Tissue parasites and Lymph parasite <b>2.3</b> Types of host: Definitive, Intermediate, Paratenic or carrier, reservoir host and vectors. <b>2.4</b> Sources of infection: Soil, water, air, food, insect vectors, domestic and wild animals <b>2.5</b> Mode of Transmission: Oral, Skin, Vector	10	10
3	<b>Health and Diseases</b> Brief account of life cycle, mode of transmission pathogenicity, prevention and control w.r.t. Human <b>3.1</b> Viral diseases : Swine flu and Chikungunya <b>3.2</b> Bacterial diseases : Anthrax and tetanus <b>3.3</b> Protozoon diseases: Amoebiasis and Malaria <b>3.4</b> Helminthes diseases: Ascariasis and Taeniasis	12	12
4	<b>Major insect vectors of public health importance</b> <b>4.1</b> House fly, <b>4.2</b> Flea, <b>4.3</b> Bed bug, <b>4.4</b> Head louse	6	6
5	<b>Insect vectors of medical importance</b> <b>5.1</b> <i>Culex</i> – Filariasis <b>5.2</b> <i>Anopheles</i> – Malaria <b>5.3</b> <i>Aedes</i> – Dengue w.r.t . their distinguishing characters, mode of transmission of pathogen, sign and symptoms, prevention and control of diseases. <b>5.4</b> Biological and chemical control of mosquitoes	8	8
6	<b>Epidemic diseases</b> Source of infection, sign and symptoms, prevention and control of - <b>6.1</b> Typhoid and <b>6.2</b> Cholera	8	8
7.	<b>Introduction and importance of medical diagnostics</b> <b>7.1</b> Hb estimation, <b>7.2</b> Cholesterol level, <b>7.3</b> Blood and Urine sugar level, <b>7.4</b> Sonography, <b>7.5</b> Angiography, <b>7.6</b> CT scan, <b>7.7</b> M.R. I.	8	8
8	<b>Forensic Entomology</b> <b>8.1</b> Introduction and importance <b>8.2</b> Post mortem changes <b>8.3</b> Role of Insects	5	5
<b>Total</b>		<b>60</b>	<b>60</b>

## ZOO 233 – Practical corresponding to ZOO 232

1. Study of permanent slides or microphotographs of the following: Chikungunya virus, Swine flu, Anthrax virus, Tetanus.
2. Study of the following parasite w.r.t. life cycle and pathogenicity: *E. histolytica*, *Ascaris* male/ female, *Taenia solium*,
3. Study of following insect vector with the help of permanent slide / photographs: Head Louse, Flea, House fly, Bed bug.
4. Comparative study of mosquitoes: *Aedes*, *Culex* and *Anopheles*.
5. Study of epidemic diseases: Typhoid and Cholera w.r.t. sign and symptoms, source of infection, prevention and control measures.
6. Study of the following (E):
  - i. Hb estimation.
  - ii. Urine sugar level tests

### Suggested Books

1. Epidemiology and Fundamental of infectious diseases – M.L.Volvskaya.
2. Natural history of infectious diseases – Burnet M & D (1972) Cambridge University press Cambridge London.
3. Introduction to parasitology 10 th Ed.Chandle A.C. & C.P. Real (1970).
4. The biology of animal parasitology 3rd Ed. Latey E.A.
5. General parasitology – Dogiel V.A. London.
6. A modern text book of parasitology Dr. A. N. Latey, Narendra Prakashan.
7. Textbook of medical parasitology - CK Jayaram Panikar, Jaypee Brothers, New Delhi
8. A Textbook of Medical Technology – Vol I and II - Darshan P. godkar Praful B. Godkar, Bhalani Publishing House; 3rd edition (2014)
9. Medical Laboratory Technology - VOL 1, 2/E, K. L. Mukherjee, Tata McGraw-Hill Education

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**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**  
**Sem – I Paper –I – ZOO 241: Chordates-II**

Units	Topic	Periods	Marks
<b>Animal Type: <i>Columba livia domestica</i></b>			
1	I) Introduction: <i>Columba livia</i> II) a) Systematic position; b) Habits and Habitat; c) distribution.	2	2
2	External Morphology: a) Shape & Size; b) Colouration; c) Body division- Head, Neck, Trunk and Tail d) Skin: Histology of skin.	4	4
3	Exoskeleton: a) claws and Beak; b) Feathers-Structure of a Typical feather and Types	4	4
4	<b>Internal Anatomy:</b> A) Digestive system: i) Alimentary canal and Digestive glands; ii) Food, Feeding and digestion	6	6
	B) Respiratory system: i) Respiratory tract ii) Respiratory organs: Lungs and Air sacs; functions of air sacs.	6	6
	C) Circulatory system: i) Heart: External and Internal structure; ii) Working of heart; iii) Arterial system; iv) Venous system; vi) Blood. v) Mechanism of blood circulation (double circulation).	6	6
	D) Nervous system: i) Central nervous system : Brain (Dorsal & ventral view), ventricles of brain and Spinal cord; ii) Peripheral Nervous system: Cranial nerves (Mention only names, types, origin, insertion, function) iii) Autonomous nervous system; iv) Spinal nerves; v) Sense organ; Ear and Eye.	6	6
	E) Urinogenital system: i) Male urinogenital system; ii) Female Urinogenital system, iii) Significance of one ovary iv) Copulation.	6	6
	F) Economic Importance of <i>Columba livia domestica</i>	2	2
<b>General topics</b>			
5	1) Accessory respiratory organs in fishes: a) Air bladder, b) Air Chambers, c) Bucco-pharyngeal epithelium, d) Alimentary canal, e) Saccular organs, f) Labyrinthine organs, g) Arborescent organ, h) Branchial chamber. 2) Reptiles of Mesozoic era. 3) Adaptations in aquatic Mammals , Ex. Whale and Seal	18	18
<b>Total</b>		<b>60</b>	<b>60</b>

## ZOO 243 Practicals corresponding to ZOO 241

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

1. External characters of *Columba livia* and Study of exoskeleton: a) Claws and Beak; b) Study of a structure of typical feather (paste a feather in journal of any bird) & Types (D).
2. Study of internal anatomy
  - a) Digestive system of *Columba livia* (D)
  - b) Respiratory system of *Columba livia* (D)
  - c) Arterial system of *Columba livia* (D)
  - d) Venous system of *Columba livia* (D)
3. Study of internal anatomy
  - a) Nervous system: Brain (Dorsal and Ventral view) *Columba livia* (D)
  - b) Excretory system of *Columba livia* (D)
  - c) Male reproductive system of *Columba livia* (D)
  - d) Female reproductive system of *Columba livia* (D)
4. Temporary mountings of scales: Placoid and Ctenoid scales (E).
5. Study of Fins : Scoliodon and Anabas (E)
6. Study of dinosaurs *Brontosaurus*, *Tyranosaurus*, *Stegosaurus*, *Triceratops*, *Pteranodon*. (D).
7. Adaptations in aquatic Mammals, Ex. Whale and Seal. (D).

### Suggested Books

1. A life of Vertebrate – K. Z. Young, ELBS Oxford University Press.
2. Modern Text Book of Zoology Vertebrate – R. L. Kotpal, Rastogi Publication Meerut.
3. A Text Book of Chordate Zoology – R. C. Dalela –Jaiprakashnath Publication Meerut.
4. Chordate Zoology – E. L. Jordan and P. S. Verma, S. Chand and Company New De
5. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill.
6. Biological Science, 3rd Ed. D. J. Taylor, N. P. O. Green and G. W. Stout,
7. Cambridge Univ. Press. Low priced Ed.
8. Verma and Agarwal- Chordate Embryology – S. Chand publication.

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**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**  
**Sem – I Paper –II – ZOO 242: Applied Zoology-II**

Units	Topic	Periods	Marks
1	<b>Introduction to apiculture</b> 1.1. Introduction and Scope 1.2. History of bee keeping- a) Bee keeping in India b) Bee keeping in Maharashtra	2	2
2	<b>Systematic Position of bee species</b> 2.1. Classification of honey bee 2.2. Habit and habitat 2.3. Honey bee species and their distribution- a) <i>Apis dorsata</i> , b) <i>Apis florea</i> , c) <i>Apis cerana indica</i> d) <i>Apis mellifera</i> , e) Dammer bees f) Wild bees	3	3
3	<b>Morphology of worker bee</b> 3.1. Head – Eyes, antennae, mouth parts and salivary gland 3.2. Thorax – Legs and wings 3.3. Abdomen- sting apparatus and Wax gland	8	8
4	<b>Anatomy of bee</b> 4.1. Digestive system 4.2. Circulatory system 4.3. Respiratory system 4.4. Nervous system 4.5. Reproductive system – a) Reproductive organs of male (Drone) bee, b) Reproductive organs of female (Queen) bee.	12	12
5	<b>Colony organization and life cycle</b> 5.1. Colony organization and polymorphism – a) the queen b) the drone and c) the worker (division of labour) 5.2. Life cycle of honey bee- a) nuptial flight b) metamorphosis and caste determination	6	6
6	<b>Bee behavior and communications</b> 6.1. Nesting behavior and nest architecture 6.2. Communication in bees- a) Round dance b) Wagtail dance c) Cleaning dance d) DVAV (Joy dance) e) Massage dance f) Alarm dance	6	6
7	<b>Bee keeping equipments and apiary management</b> 7.1. Introduction 7.2. Bee hive (box) - a) Langstroth hive b) Newton hive c) I.S. I. (A and B) type hive. 7.3. Bee keeping equipments – a) the bee veil b) the smoker c) the hive tool d) Gloves e) queen cage f) Comb foundation sheet g) the queen excluder h) wire entrance guard i) the queen cell protector j) dummy board k) the feeder l) the uncapping knife m) the honey extractor n) the bee brush o) Overall p) ant barrier q) the honey tank r) the drone trap. 7.4. Procurement and hiving of colonies. 7.5. Routine management – a) Cleaning, b) feeding and c) watering	10	10

	7.6. Seasonal management- a) Rainy season, b) Winter, c) Spring and d) Summer management. 7.7. Migration, Division and Uniting of colonies. 7.8. Queen rearing- Natural and artificial method		
<b>8</b>	<b>Bees and agriculture</b> 8.1. Importance of bee flora and floral calendar 8.2. Bee pollination 8.3. Role of bee in sustainable agriculture	<b>3</b>	<b>3</b>
<b>9</b>	<b>Bee diseases and enemies</b> 9.1. Bee diseases – a) Viral b) Fungal - Chalk brood and Stone brood c) Bacterial – American foul brood, European foul brood, Septicaemia, d) Protozoan disease. 9.2. Bee Parasites – a) External parasites – Mite, Louse. b) Internal parasites – Acarine disease. 9.3. Bee pest and predators	<b>6</b>	<b>6</b>
<b>10</b>	<b>Bee products</b> 10.1. Honey – Chemical composition, adulteration of honey and economic importance. 10.2. Other products and their uses - a) Pollen, b) Propolis (bee glue) c) Bee wax d) Bee venom and e) Royal jelly.	<b>4</b>	<b>4</b>
	<b>Total</b>	<b>60</b>	<b>60</b>

### **ZOO 243 – Practicals corresponding to ZOO 242**

- |  |   |
|--|---|
| 1. Study of systematic position and external morphology of honey bee           | D |
| 2. Study of Apis species of honey bee and Study of life cycle of honey bee.    | D |
| 3. Temporary mountings of pollen basket, sting apparatus and mouth parts.      | E |
| 4. Study of architecture of honey comb and Study of bee box (Langstroth hive). | D |
| 5. Study of diseases, pests, parasites and predators of honey bee              | D |
| 6. Study of bee keeping equipments and their uses                              | D |
| 7. Study of honey bee products and their uses                                  | D |
| 8. Study of honey adulteration detection test                                  | E |
| 9. Compulsory visit to an apiary   |   |

### **Suggested Books**

1. Apiculture ( 6<sup>th</sup> edition, reviewed and updated). Pierre Jean-Prost and Paul Medori. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Calcutta, Bombay.
2. Beekeeping. E. F. Phillips., Published by Agrobios (India), Jodhpur
3. Bees and Beekeeping in India. Dr. D. P. Abrol, Kalyani Publishers, Ludhiana, New Delhi, Hyderabad, Chennai, Calcutta.
4. Bee keeping for pleasure and profit. Mohammad Naim, Kalyani Publishers, Ludhiana.

5. Bee-Keeping and Man. T. B. Nikam and B. M. Deoray., Nirali Prakashan, Pune.
6. Applied Entomology. Manju Yadav., Discovery publishing house, New Delhi.
7. A text book of Applied Entomology. Vol. II. K. P. Srivastava., Kalyani Publishers, Ludhiana, New Delhi, Hyderabad, Chennai, Calcutta.
8. Economic Zoology. 4<sup>th</sup> Edition. Dr. G. S. Shukla and Dr. V. B. Upadhyay., Rastogi Publication, Meerut.
9. Honey: The most nutritious food. Dr. O. P. Chaudhari, Central Bee Research and Training Institute, Pune.

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## Equivalence: Theory and Practicals

**Class: S. Y. B. Sc.**

**Subject : Zoology**

<b>Paper</b>	<b>Old Course (W.E.F. From 2013-14)</b>	<b>Paper</b>	<b>New Courses (to be implemented from June 2016)</b>
<b>Semester I</b>			
ZOO 231	Nonchordates – II	ZOO 231	Nonchordates – II
ZOO 232	Mammalian Histology	ZOO 232	Medical Zoology
<b>Semester II</b>			
ZOO 241	Chordates – II	ZOO 241	Chordates – II
ZOO 242	Mammalian Physiology	ZOO 242	Applied Zoology
<b>PRACTICAL</b>			
ZOO 203	Based on ZOO 231, ZOO 232, ZOO 241 and ZOO 242	ZOO 233	Based on ZOO 231 and ZOO 232
		ZOO 243	Based On ZOO 241 and ZOO 242

**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**  
**Sem – I Paper –II – ZOO 233: PRACTICAL**

**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]
2. Study of Digestive System of Sea star
3. Study of Water vascular system of sea star
4. Study of various Canal System in Sponges
5. Study of Locomotion in Protozoa
6. Study of Modification of foot in Mollusca
7. Mounting of Mouth Parts of Grasshopper /Cockroach / Anopheles etc
8. Visit to any Ecosystem

**ZOO 233 – Practical corresponding to ZOO 232**

1. Study of permanent slides or microphotographs of the following: Chikungunya virus, Swine flu, Anthrax virus, Tetanus.
2. Study of the following parasite w.r.t. life cycle and pathogenicity: *E. histolytica*, *Ascaris* male/ female, *Taenia solium*,
3. Study of following insect vector with the help of permanent slide / photographs: Head Louse, Flea, House fly, Bed bug.
4. Comparative study of mosquitoes: *Aedes*, *Culex* and *Anopheles*.
5. Study of epidemic diseases: Typhoid and Cholera w.r.t. sign and symptoms, source of infection, prevention and control measures.
6. Study of the following (E):
  - i. Hb estimation.
  - ii. Urine sugar level tests

**North Maharashtra University, Jalgaon**  
**S. Y. B. Sc. Zoology Syllabus w.e.f. June 2016**  
**Sem – I Paper –II – ZOO 243: PRACTICAL**

**ZOO 243 Practicals corresponding to ZOO 241**

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

1. External characters of *Columba livia* and Study of exoskeleton: a) Claws and Beak; b) Study of a structure of typical feather (paste a feather in journal of any bird) & Types (D).
2. Study of internal anatomy
  - a) Digestive system of *Columba livia* (D)
  - b) Respiratory system of *Columba livia* (D)
  - c) Arterial system of *Columba livia* (D)
  - d) Venous system of *Columba livia* (D)
3. Study of internal anatomy
  - a) Nervous system: Brain (Dorsal and Ventral view) *Columba livia* (D)
  - b) Excretory system of *Columba livia* (D)
  - c) Male reproductive system of *Columba livia* (D)
  - d) Female reproductive system of *Columba livia* (D)
4. Temporary mountings of scales: Placoid and Ctenoid scales (E).
5. Study of Fins : Scoliodon and Anabas (E)
6. Study of dinosaurs *Brontosaurus*, *Tyranosaurus*, *Stegosaurus*, *Triceratops*, *Pteranodon*. (D).
7. Adaptations in aquatic Mammals, Ex. Whale and Seal. (D).

**ZOO 243 – Practicals corresponding to ZOO 242**

- |  |   |
|--|---|
| 1. Study of systematic position and external morphology of honey bee               | D |
| 2. Study of <i>Apis</i> species of honey bee and Study of life cycle of honey bee. | D |
| 3. Temporary mountings of pollen basket, sting apparatus and mouth parts.          | E |
| 4. Study of architecture of honey comb and Study of bee box (Langstroth hive).     | D |
| 5. Study of diseases, pests, parasites and predators of honey bee                  | D |
| 6. Study of bee keeping equipments and their uses                                  | D |
| 7. Study of honey bee products and their uses                                      | D |
| 8. Study of honey adulteration detection test                                      | E |
| 9. Compulsory visit to an apiary   |   |