



# BANKURA UNIVERSITY

(West Bengal Act XIX of 2013- Bankura University Act, 2013)

Main Campus, Bankura Block-II, P.O.: Purandarpur, Dist.: Bankura, Pin- 722155, West Bengal

## Office of the Secretary

### Faculty Council for Undergraduate Studies

Ref. BKU/FCUG/178/2023

Date: 10/07/2023

### **NOTIFICATION**

As directed, the undersigned is pleased to inform all concerned that Bankura University has initiated the process to implement New Curriculum and Credit Framework for Undergraduate Programme, UGC 2022 (as per NEP 2020) for 4-years Undergraduate programme with Zoology as Major, Minor etc. from the academic session 2023-2024. The Syllabus for the purpose will be framed and finalized as per the guidelines of appropriate authority. As an important corollary to the process, the workshop through online mode will be organized on the date mentioned herewith to get the feedback from the stakeholders. Present Students, Alumni, Guardians, Academicians and other stakeholders related to the specific programme/course are requested for their kind participation in the workshop and to present their views/ observations etc. The stakeholders may go through the draft syllabus attached herewith and convey their observations to the office of the undersigned on [ugsecretaryoffice@bankurauniv.ac.in](mailto:ugsecretaryoffice@bankurauniv.ac.in) within seven days from the date of publication of notice.

Date: 15<sup>th</sup> July, 2023.

Time: 7:30pm onwards

Google Meet joining info

Video call link: <https://meet.google.com/xqx-inqe-nao>

Sd/-

Dr. Arindam Chakraborty

Secretary

Faculty Council for Undergraduate Studies



# **Syllabus for Four Years Undergraduate Courses in Zoology**

**[New Curriculum and Credit Framework for undergraduate Programme]**

**Following NEP 2020**

**With effect from the Academic Session 2023-2024]**



**BANKURA UNIVERSITY**

**BANKURA**

**WEST BENGAL**

**PIN 722155**



**Bankura University**  
Programme and Course Structure with Credit Distribution: UG Degree Programmes with Single Major

Category of Course (credit)	Major (4)		Minor Stream (4)	Multidisciplinary (3)	Ability Enhancement Courses (AEC) (2)	Skill Enhancement Courses (SEC) (3)	Value Added Courses common for all (4)	Summer Internship (2)	Research Project / Dissertation* (12)	TOTAL CREDIT / NUMBER OF COURSES
	DSC	DSE								
SEM										
I	4		4	3	2	3	4			20
II	4		4	3	2	3	4			20
<b>CERTIFICATE (Total credit)</b>	<b>8</b>		<b>8</b>	<b>6</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>4*(ADDITIONAL)</b>		<b>40</b>
III	8		4	3	2	3				20
IV	16		4		2					22
<b>DIPLOMA (Total credit)</b>	<b>32</b>		<b>16</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>4*(ADDITIONAL)</b>		<b>82</b>
V	8	8	4					2		22
VI	8	8	4							20
<b>UG DEGREE (Total credit)</b>	<b>64</b>		<b>24</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>2</b>		<b>124</b>
VII	4	12	4							20
VIII	4	12**	4							20
<b>UG HONS. (total credit)</b>	<b>96</b>		<b>32</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>2</b>		<b>164</b>
<b>UG HONS. WITH RESEARCH (Total credit)</b>	<b>84</b>		<b>32</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>8</b>	<b>2</b>	<b>12**</b>	

### Undergraduate Courses in Zoology

Courses	Duration	Semesters	Credits	Criteria of Admission /Re entry
<b>Certificate course in Zoology</b>	1 year	I & II	40+ 4 (Voc)	12+ Pass with Biology
<b>Diploma course in Zoology</b>	2 years	I-IV	82+ 4 (Voc)	Certificate in Zoology
<b>B.Sc degree in Zoology</b>	3 years	I-VI	124+2(Voc)	Diploma in Zoology
<b>B.Sc (Honours) in Zoology</b>	4 years	I-VIII (without dissertation)	164	3 years B.Sc degree in Zoology
<b>B.Sc (Honours with Research) in Zoology</b>	4 years	I-VIII (with dissertation)	164	3 years B.Sc degree in Zoology with average at least 75% marks.



# Curriculum and Credit Framework for ZOOLOGY

(Basic, Honours and Honours with Research)  
With effect from the Academic Year 2023-2024

SEMESTER-I										
Sl.No.	Course Code	Course Title	Credit	Marks			No.of Hours			
				IA	ESE	Total	L	T	P	
1	DSC-01	Non chordate Diversity	3+1	10	40		50	3	0	2
					T:25	L:15				
2	MNS-01	Non chordate	3+1	10	40		50	3	0	2
					T:25	L:15				
3	MDC-01	Sericulture and Silk Production Technology	3	10	40		50	3	0	0
					T:40					
4	AECC-01		2							
5	SEC-01	Sericulture	3	10	40		50	3	0	0
					T:40					
6	VAC-01		4							
<b>Total in Semester-I</b>			<b>20</b>							

SEMESTER-II										
Sl.No.	Course Code	Course Title	Credit	Marks			No.of Hours			
				IA	ESE	Total	L	T	P	
1	DSC-02	Chordate Diversity and Comparative Anatomy of Vertebrates	4	10	40		50	3	0	2
					T:25	L:15				
2	MNS-02	Chordate and Comparative Anatomy	4	10	40		50	3	0	2
					T:25	L:15				
3	MDC-02	Environment and Public Health Management	3	10	40		50	3	0	0
					T:40					
4	AECC-02		2							
5	SEC-02	Aquarium Fish Management	3	10	40		50	3	0	0
					T:40					
6	VAC-02		4							
<b>Total in Semester-II</b>			<b>20</b>							

- Major Courses in Zoology are for the students who opted for Certificate/Diploma/Degree in Zoology
- Minor Courses in Zoology for the students opted whose major courses other than Zoology.
- Multidisciplinary subject (for the students who do not studied the subject in H.S. level).
- Skill Enhancement Course (SEC) for the students of Zoology Major.
- Summer Internship one of 4 credits is compulsory within 1<sup>st</sup> year for Certificate, within 2<sup>nd</sup> year for Diploma, within 3 year for degree and within 4<sup>th</sup> year for Degree with Honours.



## Zoology Major

### Semester- I

#### Paper I : Non chordate Diversity

3 Credits

##### Unit 1: Introduction

Coelom: Types, Evolution and significance

##### Unit 2: Basics of Animal Classification

1. Definitions: Classification, Systematics and Taxonomy: Taxonomic Hierarchy, Taxonomic types
2. Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Six kingdom concept of classification (Carl Woese)

##### Unit 3: Protista

Protozoa:

General characteristics and classification up to phylum (Levine et. al., 1981)

Locomotion in Protozoa with special reference to *Euglena*, *Paramecium* and *Amoeba*; Conjugation in *Paramecium*.

##### Unit 4: Porifera

1. General characteristics and classification up to Classes (Hyman 1940)
2. Canal system and spicules in sponges

##### Unit 5: Cnidaria

1. General characteristics and classification up to classes
2. Metagenesis in *Obelia*
3. Corals and coral reef diversity, function & conservation

##### Unit 6: Platyhelminthes

General characteristics and classification up to classes

##### Unit 7: Nematoda

1. General characteristics and classification up to classes
2. Parasitic adaptations in helminthes

##### Unit 8: Annelida

1. General characteristics and classification up to classes
2. Reproduction in earthworm.

##### Unit 9: Arthropoda

1. General characteristics and classification up to classes
2. Social life in termite

##### Unit 10: Onychophora

General characteristics and Evolutionary significance of *Peripatus*

##### Unit 11: Mollusca

1. General characteristics and Classification up to classes
2. Nervous system and torsion in Gastropoda

##### Unit 12: Echinodermata

1. General characteristics and Classification up to classes
2. Water-vascular system in *Asterias*

##### Unit 13: Hemichordata

1. General characteristics of phylum Hemichordata.
2. Evolutionary significance of Hemichordates

**Reference Books**

- Barnes, R. D. & Ruppert, E. E., (1994). Invertebrate Zoology. 6th Ed. Brooks Cole  
Brusca, R. C. & Brusca, G. J. (2002). Invertebrates. 4th Ed. Sinauer Associates  
Mandal FB (2015), Human Parasitology 2nd Edition, PHI Learning  
Kapoor, V. C. (2008). Theory and practice of animal taxonomy. 6th Ed. Oxford & IBH Pub  
Mayr, E. (1969). Principles of Systematic Zoology. Tata McGraw-Hill.  
Mayr, E. & Ashlock, P. D. (1991). Principles of Systematic Zoology. 2nd Ed., McGraw-Hill.  
Meglitsch, P. A. & Schram, F. R. (1991). Invertebrate Zoology. Oxford University Press  
Pechenik, J. A. (1998). Biology of the Invertebrates, 4th Ed. McGraw Hill  
Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.  
Sinha, K. S., Adhikari, S., & Ganguly, B. B. Biology of Animals. Vol. I. New Central Book Agency. Kolkata

**Paper I : Non chordate Diversity****1 Credit****Practicals**

1. Identification of following specimen  
*Amoeba, Euglena, Paramecium, Sycon, Fasciola, Ascaris Physalia, Aurelia, Gorgonia, Metridium, Pennatula, Fungia, Aphrodite, Pheretima, Hirudinaria, Balanus, Eupagurus, Scolopendra, Peripatus Chiton, Pinctada, Octopus, Nautilus, Asterias, Balanoglossus*
2. Identification of T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
3. Dissection of digestive system and nervous system of earthworm
4. Dissection of reproductive system of earthworm
5. Dissection: digestive system and nervous system of Cockroach
6. a. Mounting of mouth parts of Cockroach  
b. Staining and mounting of any protozoa/helminth from gut of cockroach.
7. Submission of Laboratory Note Book

**Distribution of Marks****Examination Pattern:**

1. Identification with reasons (any three):
2. Dissection (any one) (From Item no. 3, 4 and 5 )
3. Staining/ Mounting (any one) (From Item no. 6):
4. Laboratory Note book

	<b>Full marks: 15</b>
	3x2= 6
	4 [2+1=1]
	3 [1+1+1]
	2

**\*Note:**

Q1. For Item (1), Sc. name:0.5 mark, Systematic Position 0.5 and Reasons: 1 marks. For Item (2) 1 mark is allotted for both identification and characters.

**Suggested readings:**

- Ghosh, K.C. and Manna, B. (2015):Practical Zoology, New Central Book Agency, Kolkata  
Poddar T. K., S. Mukherjee & S. K. Das (2002) An Advanced Laboratory Manual of Zoology, Laxmi Publications  
Sinha, J.K., Chatterjee, A.K. and P. Chattopadhyay (2015) Advanced Practical Zoology



## Zoology Major

### Semester -II

#### Paper II : Chordate Diversity and Comparative Anatomy of Vertebrate

3 Credits

#### Group A

##### **Unit 1: Introduction to Chordates**

Origin of Chordate (Dipleurula concept and the Echinoderm theory)

##### **Unit 2: Urochordata and Cephalochordata**

1. General characteristics and classification of Urochordata and Cephalochordata up to Classes.
2. Retrogressive metamorphosis in *Ascidia*.

##### **Unit 3: Agnatha**

General characteristics and classification of cyclostomes up to order

##### **Unit 4: Pisces**

1. General characteristics and classification of Chondrichthyes and Osteichthyes up to Subclasses
2. Migration in fishes
3. Structure and function of Swim bladder

##### **Unit 5: Amphibia**

1. General characteristics and classification up to living Orders.
2. Parental care in Amphibia

##### **Unit 6: Reptilia**

1. General characteristics and classification up to living Orders.
2. Poison apparatus and biting mechanism in snakes

##### **Unit 7: Aves**

1. General characteristics and classification up to Sub-Classes
2. Migration in birds
3. Aerodynamics of flight

##### **Unit 8: Mammals**

1. General characters and classification up to living orders
2. Affinities and phylogeny of Monotremata
3. Echolocation in micro chiropterans

#### GROUP B

##### **Unit 1: Integumentary System**

Structure, function and derivatives of integument in amphibian, birds and mammals

##### **Unit 2: Skeletal System**

General idea of Axial and appendicular Skeleton

##### **Unit 3: Digestive System**

Ruminating stomach; dentition in mammals

##### **Unit 4: Respiratory System**

Respiratory organs in fish, amphibian, and birds

##### **Unit 5: Circulatory System**

Comparative account of heart and aortic arches

**Unit 6: Urinogenital System**

Archinephros, Pronephros, Mesonephros and Metanephros Evolution of urinogenital ducts,

**Unit 7: Nervous System**

Comparative account of brain, Cranial nerves in mammals

**Unit 8: Sense Organs**

Classification of receptors

**Note: Classifications for Protochordata, Agnatha, Reptilia, Aves and Mammalia to be followed from Young (1981), for Pisces to be followed from Romer (1959), for Amphibia to be followed from Nobel (1924).**

**Reference Books**

- Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.  
 Futuyama, D. (1997). Evolutionary Biology. 3rd Ed. Sinauer Associates, INC.  
 Hall B.K. and Hallgrímsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc. Jordan, E.L. & Verma, P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi.  
 Kardong, K. V. (2002). Vertebrates: Comparative anatomy, function evolution. Tata McGraw Hill.  
 Kent, G. C. & Carr, R. K. (2001). Comparative anatomy of the Vertebrates. 9th Ed. McGraw Hill.  
 Mandal FB (2013) Vertebrate Zoology, Oxford and IBH Co Pvt Ltd, New Delhi  
 Nelson, J.S., (2006): Fishes of the World, 4th Edn., Wiley.  
 Parker, T. J. & Haswell, W. (1972). Text Book of Zoology, Volume II: Marshall and Wiliam (Eds.) 7th Ed. Macmillan Press, London.  
 Pough H. Vertebrate life, VIII Edition, Pearson International.  
 Romer, A. S. & Parsons, T. S. (1986). The vertebrate body. 6th Ed. Saunders College Publishing.  
 Sinha, K. S., Adhikari, S., Ganguly, B. B. & Bharati Goswami, B. D. (2001). Biology of Animals. Vol. II. New Central Book Agency (p) Ltd.  
 Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.  
 Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education  
 Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies  
 Hilderbrand, M (1988) . Analysis of Vertebrate Structure. 3<sup>rd</sup> Edition, John Wiley and Sons  
 Saxena, R.K. & Saxena, S.C. (2008): Comparative Anatomy of Vertebrates, Viva Books Pvt. Ltd.

**Paper II : Chordate Diversity and Comparative Anatomy of Vertebrates Lab****1 Credits****Practicals**

1. Identification of following specimen  
*a. Branchiostoma, Petromyzon, Scoliodon, Torpedo, Heteropneustes, Exocoetus, Hippocampus, Necturus, Bufo, Tylostotriton, Chelone, Chamaeleon, Draco, Viper, Naja, Pteropus, Funambulus,*
2. Identification of disarticulated skeleton of Pigeon and Guinea pig [Skull, Vertebrae (Atlas, Axis) and Pectoral girdle, Pelvic girdle],
3. Mounting of Pecten from Fowl head
4. Staining and mounting of placoid, cycloid and ctenoid scales
5. Dissect out brain of carp
6. Dissection: Afferent branchial arterial system and IX and Xth cranial nerves of carp
7. Submission of Laboratory Note Book

**Distribution of Marks****Examination Pattern:****Full marks: 15**

- |   |            |
|---|------------|
| 1. Identification with reasons (any three): | 6 (2+2+2)* |
| 2. Mounting and staining                    | 2          |
| 3. Dissection                               | 5 [3+1+1]* |
| 4. Submission of laboratory note book:      | 2          |





# Zoology Minor

## Semester- I

### Paper I : Non chordate

3 Credits

#### Unit 1: Introduction

Coelom: Types, Evolution and significance

#### Unit 2: Basics of Animal Classification

1. Definitions: Classification, Systematics and Taxonomy: Taxonomic Hierarchy, Taxonomic types
2. Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Six kingdom concept of classification (Carl Woese)

#### Unit 3: Protista

1. Protozoa:

General characteristics and classification up to phylum (Levine et. al., 1981)

Locomotion in Protozoa with special reference to *Euglena*, *Paramecium* and *Amoeba*; Conjugation in *Paramecium*.

#### Unit 4: Porifera

1. General characteristics and classification up to Classes (Hyman 1940)
2. Canal system and spicules in sponges

#### Unit 5: Cnidaria

1. General characteristics and classification up to classes
2. Metagenesis in *Obelia*
3. Corals and coral reef diversity, function & conservation

#### Unit 6: Platyhelminthes

1. General characteristics and classification up to classes

#### Unit 7: Nematoda

1. General characteristics and classification up to classes
2. Parasitic adaptations in helminthes

#### Unit 8: Annelida

1. General characteristics and classification up to classes
2. Reproduction in earthworm.

#### Unit 9: Arthropoda

1. General characteristics and classification up to classes
2. Social life in termite

#### Unit 10: Onychophora

General characteristics and Evolutionary significance of *Peripatus*

#### Unit 11: Mollusca

1. General characteristics and Classification up to classes
2. Nervous system and torsion in Gastropoda

#### Unit 12: Echinodermata

1. General characteristics and Classification up to classes
2. Water-vascular system in *Asterias*

#### Unit 13: Hemichordata

1. General characteristics of phylum Hemichordata.
2. Evolutionary significance of Hemichordates



Note: Classification to be followed from Barnes and Ruppert 1994, 6<sup>th</sup> Edition

### Reference Books

- Barnes, R. D. & Ruppert, E. E., (1994). Invertebrate Zoology. 6th Ed. Brooks Cole  
 Brusca, R. C. & Brusca, G. J. (2002). Invertebrates. 4th Ed. Sinauer Associates  
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 Sinha, K. S., Adhikari, S., & Ganguly, B. B. Biology of Animals. Vol. I. New Central Book Agency. Kolkata

## Paper I : Non chordate

1 Credit

### Practicals

- Identification of following specimen  
*Amoeba, Euglena, Paramecium, Sycon, Fasciola, Ascaris Physalia, Aurelia, Gorgonia, Metridium, Pennatula, Fungia, Aphrodite, Pheretima, Hirudinaria, Balanus, Eupagurus, Scolopendra, Peripatus, Chiton, Pinctada, Octopus, Nautilus, Asterias, Balanoglossus*
- Identification of T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
- Dissection of digestive system and nervous system of earthworm
- Dissection of reproductive system of earthworm
- Dissection: digestive system and nervous system of Cockroach
- a. Mounting of mouth parts of Cockroach  
 b. Staining and mounting of any protozoa/helminth from gut of cockroach.
- Submission of Laboratory Note Book

### Distribution of Marks

#### Examination Pattern:

	Full marks: 15
1. Identification with reasons (any three):	3x2= 6 *
2. Dissection (any one) (From Item no. 3, 4 and 5 )	3 [2+1]
3. Staining/ Mounting (any one) (From Item no. 6):	4 [2+1+1]
4. Laboratory Note book	2

#### \*Note:

Q1. For Item (1), Sc. name:0.5 mark, Systematic Position 0.5 and Reasons: 1 marks. For Item (2) 1 mark is allotted for both identification and characters.

#### Suggested readings:

- Ghosh, K.C. and Manna, B. (2015):Practical Zoology, New Central Book Agency, Kolkata  
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## Zoology Minor

### Semester -II

#### Paper II : Chordate and Comparative Anatomy

3 Credits

##### Group A

##### Unit 1: Introduction to Chordates

Origin of Chordate (Dipleurula concept and the Echinoderm theory)

##### Unit 2: Urochordata and Cephalochordata

3. General characteristics and classification of Urochordata and Cephalochordata up to Classes.
4. Retrogressive metamorphosis in *Ascidia*.

##### Unit 3: Agnatha

General characteristics and classification of cyclostomes up to order

##### Unit 4: Pisces

4. General characteristics and classification of Chondrichthyes and Osteichthyes up to Subclasses
5. Migration in fishes
6. Structure and function of Swim bladder

##### Unit 5: Amphibia

3. General characteristics and classification up to living Orders.
4. Parental care in Amphibia

##### Unit 6: Reptilia

3. General characteristics and classification up to living Orders.
4. Poison apparatus and biting mechanism in snakes

##### Unit 7: Aves

4. General characteristics and classification up to Sub-Classes
5. Migration in birds
6. Aerodynamics of flight

##### Unit 8: Mammals

4. General characters and classification up to living orders
5. Affinities and phylogeny of Monotremata
6. Echolocation in micro chiropterans

##### GROUP B

##### Unit 1: Integumentary System

Structure, function and derivatives of integument in amphibian, birds and mammals

##### Unit 2:

General idea of Axial and appendicular Skeleton

##### Unit 3: Digestive System

Ruminating stomach; dentition in mammals

##### Unit 4: Respiratory System

Respiratory organs in fish, amphibian, and birds

##### Unit 5: Circulatory System

Comparative account of heart and aortic arches

**Unit 6: Urinogenital System**

Archinephros, Pronephros, Mesonephros and Metanephros Evolution of urinogenital ducts,

**Unit 7: Nervous System**

Comparative account of brain, Cranial nerves in mammals

**Unit 8: Sense Organs**

Classification of receptors

**Note: Classifications for Protochordata, Agnatha, Reptilia, Aves and Mammalia to be followed from Young (1981), for Pisces to be followed from Romer (1959), for Amphibia to be followed from Nobel (1924).**

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 Kent, G. C. & Carr, R. K. (2001). Comparative anatomy of the Vertebrates. 9th Ed. McGraw Hill.  
 Mandal FB (2013) Vertebrate Zoology, Oxford and IBH Co Pvt Ltd, New Delhi  
 Nelson, J.S., (2006): Fishes of the World, 4th Edn., Wiley.  
 Parker, T. J. & Haswell, W. (1972). Text Book of Zoology, Volume II: Marshall and Wiliam (Eds.) 7th Ed. Macmillan Press, London.  
 Pough H. Vertebrate life, VIII Edition, Pearson International.  
 Romer, A. S. & Parsons, T. S. (1986). The vertebrate body. 6th Ed. Saunders College Publishing.  
 Sinha, K. S., Adhikari, S., Ganguly, B. B. & Bharati Goswami, B. D. (2001). Biology of Animals. Vol. II. New Central Book Agency (p) Ltd.  
 Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.  
 Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education  
 Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies  
 Hilderbrand, M (1988) . Analysis of Vertebrate Structure. 3<sup>rd</sup> Edition, John Wiley and Sons  
 Saxena, R.K. & Saxena, S.C. (2008): Comparative Anatomy of Vertebrates, Viva Books Pvt. Ltd.

**Paper II : Chordate and Comparative Anatomy Lab****1 Credits****Practicals**

1. Identification of following specimen  
*Branchiostoma, Petromyzon, Scoliodon, Torpedo, Heteropneustes, Exocoetus, Hippocampus, Necturus, Bufo, Tylotriton, Chelone, Chamaeleon, Draco, Viper, Naja, Pteropus, Funambulus,*
2. Identification of disarticulated skeleton of Pigeon and Guinea pig [Skull, Vertebrae (Atlas, Axis) and Pectoral girdle, Pelvic girdle],
3. Mounting of Pecten from Fowl head
4. Staining and mounting of placoid, cycloid and ctenoid scales
5. Dissect out brain of carp
6. Dissection: Afferent branchial arterial system and IX and Xth cranial nerves of carp
7. Submission of Laboratory Note Book

**Distribution of Marks****Examination Pattern:**

3. Identification with reasons (any three):
4. Mounting and staining
5. Dissection
6. Submission of laboratory note book:

**Full marks: 15**

- 6 (2+2+2)\*  
2  
5 [3+1+1]\*  
2

**Zoology Skill Enhancement Courses (SEC-1)****Sericulture****3 Credits****Unit 1: Introduction**

Sericulture: Definition, history and present status: Silk route

Types of silkworms, Distribution and Races

Exotic and indigenous races

Mulberry and non-mulberry Sericulture

**Unit 2: Biology of Silkworm**

Life cycle of *Bombyx mori*

Structure of silk gland and secretion of silk

**Unit 3: Rearing of Silkworms**

Selection of mulberry variety and establishment of mulberry garden]

Rearing house and rearing appliances.

Disinfectants: Formalin, bleaching powder,

Silkworm rearing technology: Early age and Late age rearing

Types of mountages

Spinning, harvesting and storage of cocoons

**Unit 4: Pests and Diseases**

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates

Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial

Control and prevention of pests and diseases

**Unit 5: Entrepreneurship in Sericulture**

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture

Visit to any sericulture centre.

**Reference Books**

Manual on Sericulture; Food and Agriculture Organisation, Rome 1976

Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore

Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore

Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.

Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972. Manual of

Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.

Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.

A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.

Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986

**Zoology Skill Enhancement Courses (SEC-2)****Aquarium Fish Management****3 Credits****Unit 1: Introduction to Aquarium Fish Keeping**

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes, Setting of freshwater aquarium

**Unit 2: Biology of Aquarium Fishes**

Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angelfish, Blue morph, Anemone fish and Butterfly fish

**Unit 3: Food and feeding of Aquarium fishes**

Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator

**Unit 4: Fish Transportation**

Live fish transport - Fish handling, packing and forwarding techniques.

**Unit 5: Maintenance of Aquarium**

General Aquarium maintenance - budget for setting up an Aquarium Fish Farm as a Cottage Industry

**Zoology Multidisciplinary Paper-1****Sericulture and Silk Production Technology****3 Credits****Unit 1: Introduction**

Sericulture: Definition, history and present status: Silk route

Types of silkworms,

Exotic and indigenous races

Mulberry and non-mulberry Sericulture

**Unit 2: Biology of Silkworm**

Life cycle of *Bombyx mori*

Structure of silk gland, Composition of Silk and secretion of silk

**Unit 3: Rearing of Silkworms**

Selection of mulberry variety and establishment of mulberry garden

Rearing house and rearing appliances.

Disinfectants: Formalin, bleaching powder,

Types of mountages

Spinning, harvesting and storage of cocoons

**Unit 4: Pests and Diseases**

Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial

**Unit 5: Entrepreneurship in Sericulture**

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture

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- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972. Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986

## Zoology Multidisciplinary Paper-II

### Environment and Public Health Management

3 Credits

**Unit 1: Introduction**

Sources of Environmental hazards,

**Unit 2: Climate Change**

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health

**Unit 3: Pollution**

Air, water, noise pollution: sources, effects and control,

**Unit 4: Waste Management Technologies**

Sources of waste, types and characteristics, Solid waste disposal, Biomedical waste handling and disposal, e-waste management, 3 R principle of waste management

**Unit 5: Diseases**

Causes, symptoms and control of tuberculosis, Cholera, Minamata disease,  
Causes, symptoms and control of mosquito borne diseases – Malaria and Dengue  
Control of Mosquitoes

**Reference Books**

- Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.
- Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V.N. University Press, New York, 2003.
- Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
- UKImms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell
- Mosquito (2000) Chandra G, Sribhumi Publication Co. Kolkata Medical Entomology, Hati A. K Allied Book Agency, Kolkata