

**University of Pune**  
**Three Year B. Sc. Degree Course in**  
**Zoology**

**Principal Dr. D. K. Mhaske**  
Chairman,  
Board of Studies in Zoology  
University of Pune, Pune 411 007.

## 1) Title of the Course : B. Sc. Zoology

### F. Y. B. Sc. Zoology

(To be implemented from Academic Year 2013-14)

## 2) Preamble:

The well organized curricula including basic as well as advanced concepts in the Zoology from first year to the third year shall inspire the students for pursuing higher studies in Zoology and for becoming an entrepreneur and also enable students to get employed in the Biological research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject Zoology.

## 3) Introduction:

At **first year of under-graduation** the topics related to the fundamentals of zoology, including exposure to diversity in animal groups and industries based on the zoological areas are covered. The practical course is aimed to equipped the students with skills required for animal identification, morphological, anatomical, technical description, classification and also applications of zoology in the various industries.

At **second year under-graduation**: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. courses based on content of first year shall be introduced.

At **third year under-graduation**: Theory and practical courses in each semester shall deal with the further detailed studies of the various disciplines of the zoology subject and other branches of zoology such as Genetics, Animal Physiology, Molecular biology, Biochemistry, Microtechnique, Nonchordate and Chordate, Developmental Biology, Histology. Cell Biology, Biodiversity, Public health and hygiene, Pathology, Entomology, Biotechnology, etc. The students will also learn about use of various technical skills in the biological sciences to be helpful during research in the zoology subject.

## Objectives:

- To provide thorough knowledge about various animal sciences from primitive to highly evolved animal groups
- To make the students aware of applications of Zoology subject in various industries

- To highlight the potential of various branches to become an entrepreneur
- To equipped the students with skills related to laboratory as well as field based studies
- To make the students aware about conservation and sustainable use of biodiversity
- To inculcates interest and foundation for further studies in Zoology
- To address the socio-economical challenges related to animal sciences
- To facilitate students for taking up and shaping a successful career in Zoology

#### **4) Eligibility:**

- 1 **First Year B.Sc. :** A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the University of Pune eligibility norms.
- 2 **Second Year B.Sc. :** Keeping terms of First Year of B. Sc. with zoology as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.
- 3 **Third Year B.Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with zoology as one of the subjects.

**Note:** Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by the University of Pune. Reservation and relaxation will be as per the Government rules.

#### **5 A) Examination Pattern:**

##### **First Year B. Sc. Zoology**

Pattern of Examination: Annual

Theory courses	Zoology Theory Paper I : Annual
	Zoology Theory Paper II : Annual
Practical Course	Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of <b>20</b>	External marks out of <b>80</b>	Total marks out of <b>100</b>
Theory Paper I ZY-101 (First term)	Animal Systematics and Diversity -I	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper I ZY-101 (Second term)	Animal Systematics and Diversity -II	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II ZY-102 (First term)	Fundamentals of Cell Biology	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper II ZY-102 (Second term)	Genetics	Three lectures/Week (Total 36 lectures per term)			
Practical Paper III ZY-103 (First & Second Term)	Practical	9 Practicals of 4 lectures in each term (18 practicals / year)	08	32	40 *

\* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100 ) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests

**Theory examination** will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2 and 3	4 out of 6 - short answer type questions; answerable in 8 – 10 lines
Question 4	2 out of 4 – Descriptive answer type questions, answerable in 15 – 20 lines
Question 5	1 out of 2 – Descriptive answer type questions, answerable in 35 – 40 lines

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks in each term. The written test shall comprise objective type questions – Multiple Type Questions, True / False, Definitions, Answer in one or two line questions. There shall be 20 questions.

Practical: Regular assessment of each practical for 20 marks each: Marks for journal: 10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

**Practical Examination:** Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

### Second Year B. Sc. Zoology

Pattern of examination: Semester

Theory courses ZY- 211 and ZY- 212: Semester

ZY-211 and ZY-212: Semester

Practical Course: Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
ZY- 211	Animal Systematics and Diversity -III	Four lectures/Week (Total 48 per semester )	04	16	20 *
ZY- 212	Applied Zoology I	Four lectures/Week (Total 48 per Semester )	04	16	20 *
ZY-211	Animal Systematics and Diversity -IV	Four lectures/Week (Total 48 per Semester )	04	16	20 *
ZY-212	Applied Zoology II	Four lectures/Week (Total 48 per Semester )	04	16	20 *
ZY-223 (Semester- I and II)	Paper III Practical course	12 Practicals of 4 lectures in each Semester (24 practicals / year)	08	32	40**

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\*Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50 ) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests.
4. Internal marks for Practical Course should be a regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks as follows: The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10-15 lines	5 marks each
Question 4	1 out of 2 sub-questions, each of 10 marks; long answer type questions (20-25lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

## Third Year B. Sc. Zoology

Pattern of examination: Semester

Theory courses:

(Sem III: ZY-331 to ZY-336) : Semester

(Sem IV: ZY- 341 to ZY-346) : Semester

Practical Course:(ZY-347-349) : Annual

<b>Theory Papers</b>					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
<b>SEM III</b>					
ZY-331	Animal Systematics and Diversity V	48	4	16	20*
ZY-332	Mammalian Histology	48	4	16	20*
ZY-333	Biological Chemistry	48	4	16	20*
ZY-334	Environmental Biology and Toxicology	48	4	16	20*
ZY-335	Parasitology	48	4	16	20*
ZY-336	General Pathology or Cell Biology	48	4	16	20*
<b>SEM IV</b>					
ZY-341	Biological Techniques	48	4	16	20*
ZY-342	Mammalian Physiology and Endocrinology	48	4	16	20*
ZY-343	Genetics and Molecular Biology	48	4	16	20*
ZY-344	Organic Evolution	48	4	16	20*
ZY- 345	General Embryology	48	4	16	20*
ZY-346	Public Health and Hygiene or Medical Entomology	48	4	16	20*

Practical Papers					
BO 347 (Semester III & IV)	Practical Paper I	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 348 (Semester III & IV)	Practical Paper II	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 349 (Semester III & IV)	Project Practical Paper III	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **

\* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

\*\*Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester ( $50 \times 6$ ) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Theory examination** will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines	5 marks each
Question 4	2 out of 3 sub-questions, each of 10 marks; long answer type questions (20 – 25 lines)	10 marks

**Internal examination:** Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions.



Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

**Practical Examination:** Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

### **5 B) Standard of Passing:**

- i. In order to pass in the first year theory examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Theory Examination.)
- ii. In order to pass in the Second Year and Third Year theory examination, the candidate has to obtain 20 marks out of 50 in each course of each semester. (Minimum 16 marks out of 40 must be obtained in the University Theory Examination.)
- iii. In order to pass in practical examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Examination.)

### **5 C) ATKT Rules:**

While going from F.Y.B.Sc. to S.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed while going to T.Y.B.Sc.

While going from S.Y.B.Sc. to T.Y.B.Sc., at least 12 courses (out of 20) should be passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

### **5 D) Award of Class:**

The class will be awarded to the student on the aggregate marks obtained during the second and third year in the principal subject only. The award of the class shall be as follows:

1	Aggregate 70% and above	First Class with Distinction
2	Aggregate 60% and more but less than 70%	First Class
3	Aggregate 55% and more but less than 60%	Higher Second Class
4	Aggregate 50% and more but less than 55%	Second Class
5	Aggregate 40% and more but less than 50%	Pass Class
6	Below 40%	Fail

### **5 E) External Students:**

There shall be no external students.

### **5 F) Setting of question papers:**

**F. Y. B. Sc.:** For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III, papers shall be set by the University of Pune and assessment done at the respective colleges.

**S. Y. B. Sc. and T. Y. B. Sc.:** For theory papers for each semester and also for the annual practical examination, question papers shall be set by the University of Pune. Centralized assessment for theory papers done as per the University instructions. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers, papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

### **5 G) Verification and Revaluation Rules:**

As per University Statues and Rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

## **6) Course Structure:**

**Duration:** The duration of B.Sc. Zoology Degree Program shall be three years.

### **a) Compulsory Papers:**

F. Y. B. Sc.: 2 Theory + 1 Practical (Annual)

S. Y. B. Sc.: 2 Theory per semester + 1 Practical (Annual)

T. Y. B. Sc.: 6 Theory per semester + 3 Practical (Annual)

### **b) Question Papers :**

#### **F. Y. B. Sc. Theory paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

#### **S. Y. / T. Y. - B. Sc. Theory paper:**

University Examination – 40 marks (at the end of each term)

Internal Examination – 10 marks

#### **F. Y. / S. Y. / T. Y. - B. Sc. Practical Paper:**

University Examination – 80 marks (at the end of 2<sup>nd</sup> term)

Internal Examination – 20 marks

c) **Medium of Instruction:** The medium of instruction for the course shall be **English**.

### **7) Equivalence of Previous Syllabus:**

<b>Old Course (2008 Pattern)</b>	<b>New Course (2013 Pattern)</b>
Paper I: Nonchordates and Chordates	Animal Systematics and Diversity –I and II
Paper II: Genetics and Parasitology	Fundamentals of Cell Biology and Genetics
Paper III: Practical course	Paper III: Practical course

**8) University Terms:** Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

**9) Qualification of Teachers:** M.Sc. Zoology or equivalent master degree in science with class/grades and NET/SET/Ph.D. as per prevailing University/Government /UGC rules.

**UNIVERSITY OF PUNE**  
**BOARD OF STUDIES IN ZOOLOGY**  
**Proposed Revised Syllabus for F. Y. B. Sc. (Zoology)**  
**To be implemented from June, 2013**  
**F. Y. B. Sc. (Zoology) New Syllabus**

---

**1. Zoology: Paper- I**

**Term- I: Animal Systematics and Diversity –I**

**2. Zoology Theory Paper II**

**Term I: Fundamentals of Cell Biology**

**3. Zoology: Paper- I**

**Term- II: Animal Systematics and Diversity – II**

**4. Zoology: Paper- II**

**Term- II: Genetics**

**5. F. Y. B. Sc. Zoology Practical Paper - III based on Theory Paper I  
and Paper II**

UNIVERSITY OF PUNE  
BOARD OF STUDIES IN ZOOLOGY  
COURSE STRUCTURE OF UNDERGRADUATE CLASSES  
(To be implemented from June 2013)

**Class: F.Y. B. Sc.**

Paper	Course No.	Term I	Term II
I	ZY 101	Animal Systematics and Diversity -I	Animal Systematics and Diversity –II
II	ZY 102	Fundamentals of Cell Biology	Genetics
III	ZY 103	Practical course	

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

Paper	Course No.	Semester I	Course No.	Semester II
I	ZY.211	Animal Systematics and Diversity -III	ZY. 221	Animal Systematics and Diversity –IV
II	ZY.212	Applied Zoology I	ZY.222	Applied Zoology II
III	ZY.223	Practical course		

**Class: T.Y. B. Sc.**

Paper	Course	Semester III	Course	Semester IV
I	ZY.331	Animal Systematics and Diversity V	ZY.341	Biological Techniques
II	ZY.332	Mammalian Histology	ZY.342	Mammalian Physiology and Endocrinology
III	ZY.333	Biological Chemistry	ZY.343	Genetics and Molecular Biology
IV	ZY.334	Environmental Biology and Toxicology	ZY.344	Organic Evolution
V	ZY.335	Parasitology	ZY.345	General Embryology
VI	ZY.336	General Pathology or Cell Biology	ZY.346	Public Health and Hygiene or Medical Entomology
VII	ZY.347	Practicals corresponding to ZY 331, ZY 332, ZY 341 & ZY 342		
VIII	ZY.348	Practicals corresponding to ZY 333, ZY 334, ZY 343 & ZY 344		
IX	ZY.349	Practicals corresponding to ZY 335, ZY 336, ZY 345 & ZY 346		

**Prin. (Dr) D. K. Mhaske**  
Chairman, B.O.S. in Zoology  
University of Pune

## **University of Pune**

Draft of Syllabus to be implemented from June 2013

### **F. Y. B. Sc. Zoology**

Paper 1- ZY-101:	First term:	Animal Systematics and Diversity - I
	Second term:	Animal Systematics and Diversity - II
Paper II- ZY-102:	First term:	Fundamentals of Cell Biology
	Second term:	Genetics
Paper III ZY-103:		Practical course

## PAPER I: FIRST TERM

### ZY-101: ANIMAL SYSTEMATICS AND DIVERSITY -I

- 1. Principles of classification:** **4**
  - 1.1 Systematics-Linnaean hierarchy (Phylum, Class, Order, Family, Genus and Species)
  - 1.2 Binomial nomenclature
  - 1.3 Five kingdom classification system
- 2. Salient features and classification upto classes of the following:** (any two examples from each class) **8**
  - 2.1 Protozoa
  - 2.2 Porifera
  - 2.3 Coelenterata
  - 2.4 Platyhelminthes
  - 2.5 Aschehelminthes
  - 2.6 Annelida
- 3. Study of *Paramoecium* :** **8**
  - 3.1 Systematic position, Habit and habitat
  - 3.2 Structure, nutrition, excretion and reproduction (binary fission and conjugation)
- 4. Study of Earthworm :** **16**
  - 4.1 Systematic position, Habit and habitat
  - 4.2 External characters
  - 4.3 Digestive system
  - 4.4 Circulatory system
  - 4.5 Excretory system
  - 4.6 Reproductive system
  - 4.7 Nervous system and sense organs
  - 4.8 Economic importance

**PAPER –I: SECOND TERM**

**ZY-101: ANIMAL SYSTEMATICS AND DIVERSITY – II**

**1. Salient features and classification upto order with one example of the following:**

**6**

1.1 Hemichordata

1.2 Urochordata

1.3 Cephalochordata

**2. Salient features of following classes with two examples of each**

**4**

2.1 Pisces- Cartilaginous and Bony fishes

2.2 Amphibia- Apoda, Urodela and Anura

**3. Study of Frog:**

**20**

3.1 Systematic position, Habit and habitat

3.2 External characters and sexual dimorphism

3.3 Digestive system, food, feeding and physiology of digestion

3.4 Circulatory system (lymphatic system not expected)

3.5 Central Nervous system

3.6 Sense organs

3.7 Reproductive systems (male & female)

**4. General topics:**

**6**

4.1 Migration in fishes

4.2 Neoteny in amphibia

4.3 Parental care in amphibia



**PAPER II-FIRST TERM**

**ZY 102: FUNDAMENTALS OF CELL BIOLOGY**

<b>1. Introduction to cell biology:</b>	<b>4</b>
1.1 Definition and scope	
1.2 Stains: Principle and composition of vital stains, cytoplasmic stains and nuclear stains with two examples of each	
<b>2. Structure of prokaryotic (<i>E.coli</i>) and eukaryotic (Plant and Animal) cell</b>	<b>3</b>
<b>3. Structure and function of cell membrane:</b>	<b>6</b>
3.1 Chemical composition	
3.2 Fluid mosaic model	
3.3 Functions of plasma membrane	
<b>4. Composition of Cytoplasm</b>	<b>1</b>
<b>5. Study of following cell organelles with respect to structure and functions in brief:</b>	<b>10</b>
5.1 Endoplasmic reticulum	
5.2 Golgi complex	
5.3 Lysosomes, peroxisomes and glyoxysomes	
5.4 Ribosomes	
5.5 Mitochondria	
<b>6. Nucleus:</b>	<b>5</b>
6.1 Shape, size, number and position	
6.2 Ultrastructure of nuclear envelope and pore complex	
6.3 Functions	
<b>7. Cell division and their significance:</b>	<b>7</b>
7.1 Cell cycle in brief	
7.2 Mitosis	
7.3 Meiosis	

## PAPER II-SECOND TERM

### ZY 102: GENETICS

<b>1. Introduction to genetics:</b>	<b>4</b>
1.1 Mendelian inheritance: laws of heredity and their practical application	
1.2 Test cross and Back cross	
<b>2. Gene Interaction:</b>	<b>5</b>
2.1 Concept of gene interaction, co-dominance and incomplete dominance	
2.2 Complementary factors (9:7)	
2.3 Supplementary Factors (9: 3:4)	
2.4 Inhibitory factors (13:3)	
2.5 Duplicate dominant factors (15:1)	
<b>3. Lethal genes in <i>Mus musculus</i></b>	<b>1</b>
<b>4. Multiple Alleles:</b>	<b>4</b>
4.1 Concept, characteristics and importance of multiples alleles, ABO & Rh-blood group system and it's medicolegal importance.	
4.2 Concept of polygenic inheritance with reference to skin color in man	
<b>5. Chromosomes:</b>	<b>5</b>
5.1 Introduction to morphology and composition	
5.2 Classification based on the centromeric position	
5.3 Types of chromosome (autosomes and sex chromosome)	
5.2 Chromosomal aberrations: structural changes	
<b>6. Sex-determination:</b>	<b>5</b>
6.1 Introduction	
6.2 Chromosomal theory of sex determination (XX-XY, ZZ-ZW, XX-XO and Haploid-Diploid method)	
6.3 Parthenogenesis and Gynandromorphism	
<b>7. Human genetics:</b>	<b>4</b>
7.1 Study of human karyotype	
7.2 Syndromes:	
a) Autosomal-Down's (Mongolism), Patau's, Edward's and Cri-du-chat	

b) Sex chromosomal abnormalities in man: Klinefelter's and Turner's syndrome	
7.3 Inborn errors of metabolism: albinism, phenylketonuria and alkaptonuria	
<b>8. Sex linked inheritance in human:</b>	<b>3</b>
8.1 Colorblindness, haemophilia and hypertrichosis	
<b>9. Cytoplasmic inheritance:</b>	<b>1</b>
9.1 Kappa particles in <i>Paramecium</i>	
<b>10. Application of genetics:</b>	<b>4</b>
10.1 Genetic counseling.	
10.2 Concept of genetic Engineering	
10.3 Eugenics	

### ZY-103 PRACTICAL COURSE

- Practical 1. To study the classification with reasons of the following (D)  
Phylum Protozoa- *Amoeba*, *Euglena* and *Volvox*  
Phylum Porifera- *Sycon*, *Hyalonema* and *Euspogia*
- Practical 2. To study the classification with reasons of the following (D)  
Phylum Coelenterata- *Hydra*, *Physalia* and any one coral  
Phylum Platyhelminthes- Tapeworm, Planeria and Liverfluke
- Practical 3. To study the classification with reasons of the following (D)  
Phylum Aschelminthes- *Ascaris*  
Phylum Annelida- *Tubifex*, Leech and *Neries*
- Practical 4. Culturing of *Paramoecium* (E)
- Practical 5. Study of live *Paramoecium* (E)
- Practical 6. Study of external characters, binary fission & conjugation  
in *Paramoecium* (D)
- Practical 7. Study of external characters and digestive system of Earthworm (E)
- Practical 8. Study of reproductive (male and female) system of Earthworm (E)
- Practical 9. Study of nervous system of Earthworm (E)
- Practical 10. Earthworm mounting- septal nephridia, setae and spermatheca (E)
- Practical 11. Study of prokaryotic and eukaryotic cell with the help of suitable  
material (D)
- Practical 12. Study of temporary preparation of different mitotic stages  
from onion root tip cells (E)
- Practical 13. To study the classification with reasons of the following (D)  
Hemichordata- *Balanoglossus*  
Urochordata- *Doliolum/ Salpa*  
Cephalochordata- *Amphioxus*
- Practical 14. To study the classification with reasons of the following (D)  
Cartilaginous fishes- any two  
Bony fishes- any two  
Amphibia- any three

- Practical 15. Study of external characters, sexual dimorphism and digestive system of Frog with the help of model/ charts (D)
- Practical 16. Study of brain of Frog with the help of model/ chart (D)
- Practical 17. Study of monohybrid ratio and dihybrid ratio by providing hypothetical data and deducing applicability of Mendelian laws (three examples of each ratio) (E)
- Practical 18. Preparation of culture media and maintenance of *Drosophila* culture (E)
- Practical 19. Study of *Drosophila*: External characters and sexual dimorphism (D)
- Practical 20. Study of *Drosophila* mutants (any two eye and any two wing mutant) (D)
- Practical 21. Study of genetic traits in human beings (tongue rolling, widow's peak, ear lobes, color blindness and PTC tasters/ nontasters) (E)
- Practical 22. Study of normal human karyotype from metaphase chromosomal spread picture (E)
- Practical 23. Study of blood groups in human (ABO and Rh) (E)
- Practical 24. Study of any 3- cell organelles from electron micrographs (D)
- Practical 25. Compulsory visit to vermiculture unit/biodiversity spot/ZSI/large water body (E)

Note: Minimum 18 practical are to be performed by the students.

## REFERENCE BOOKS FOR F. Y. B. SC. ZOOLOGY

1. The Frog-its reproduction and development -By Robert Rugh,Tata McGraw Hill Edition,New Delhi
2. Biology of Animals By Ganguly,BB.,Sinha,A.K.,Adhikari,S.,New Central Book Agency,Kolkata
3. Arthropod Phylogeny By Gupta,A.P.,Van Nostrand Co.,New York
4. Introduction to Amphibia By Bhamrah,MS.,Juneja,K.,Amol Publication,Delhi
5. Life of Vertebrates By Young,JZ., III Edition,Clarendon Press,London
6. General Zoology By Goodnight and others IBH Publishing Co.
7. Life of Invertebrates By Prasad,ASN,Vikas Publishing House,New Delhi
8. Textbook of Vertebrate Zoology By Prasad,SN.,Kashyap,V.,New Age India Publishers,New Delhi
9. Modern Textbook of Zoology,Vertebrates By Kotpal,RL.,Rastogi and Co. Meerut
10. Phylum Protozoa to Echinodermata (series) By Kotpal,RL.,Rastogi and Co. Meerut
11. Animal Diversity By Kershaw,DR., Redwood Burn Ltd.,Trowbridge
12. Textbook of Zoology By Parkar J. and Haswell,W.,ELBS Edition
13. Textbook of Zoology By Vidyarthi, Agrasia Publishers, Agra
14. Chordate zoology By Jordan EL.,and Verma PS.,S.Chand and Co.,New Delhi
15. Functional Organization of chordates (part I and II) By Nigam HC. And Sobti,R., S.Chand and Co.,New Delhi
16. Invertebrate zoology By Barnes,Saunders College Publishing Co.,Philadelphia,USA,1987
17. Genetics By Verma,PS. And Agrawal, VK., S.Chand and Co.,New Delhi
18. Principle of Genetics By Sinnott,Dunn and Dobzhansky, Tata McGraw Hill Edition,New Delhi
19. Genetics By Gupta, PK., Rastogi Publication, Meerut
20. Genetics By Sarin,C., Tata McGraw Hill,New Delhi
21. Principles of Genetics By Gardner,EJ.,Simmons,MJ. And Snustad,DP. John Wiley and Sons
22. Cytology and Genetics By Dyanasagar VR., Tata McGraw Hill Pub. Co.Ltd.,New Delhi

23. Cell and Molecular Biology By De Robertis,EDP. And De Robertis EME,Molt  
Saunders Inc.
24. Cell Biology By Powar,CB,Himalaya Publication House
25. Cell and Molecular Biology By Dupraw I, Academic Press, New York
26. Cell Biology By avers,CJ.,Addison Wesley Pub. Co. New York and London
27. Cell and Molecular Biology By Carp,G.,John Waley, USA
28. Cell Biology By David,E.,Sadava Johnes and Bartlett Publication,London
29. Cell Structure and Function By Lowey,AG. and Siekevitz,JR.,Menninger and  
Gallew,JAN.,Saunder College Publication,Philadelphia