

II विद्या विनयेन शोभते II



Janardan Bhagat Shikshan Prasarak Sanstha's

**CHANGU KANA THAKUR  
ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL  
(AUTONOMOUS)**

Re-accredited 'A+' Grade by NAAC  
'College with Potential for Excellence' Status Awarded by UGC  
'Best College Award' by University of Mumbai

**Program: Bachelor's in Science (B. Sc.)**

**Credits: 132**

**SYLLABUS**

**(Approved in the Academic council meeting held on 12th April 2022)**

**F. Y. B. Sc. ZOOLOGY**

**Revised as per**

**Choice Based Credit System (60:40)**

**w. e. f. Academic Year 2022-23**

## BACHELOR'S IN SCIENCE (B. Sc.)

## Programme Outcomes

S. N.	After completion of B.Sc. program students will acquire	Graduate Attribute
PO1	The knowledge of the disciplines and in-depth and extensive knowledge, understanding and skills in a specific field of interest.	Disciplinary knowledge
PO2	An ability to develop and conduct experiments, analyze, and interpret data and use scientific judgment to draw conclusions	Scientific reasoning
PO3	An ability to use current technology, and modern tools necessary for creation, analysis, dissemination of information.	Digital literacy
PO4	Innovative, professional, and entrepreneurial skills needed in various disciplines of science.	Life-long learning
PO5	An ability to achieve high order communication skills.	Communication skills
PO6	An ability to collect, analyze and evaluate information and ideas and apply them in problem solving using conventional as well as modern approaches	Problem solving
PO7	A sense of social responsibility; intellectual and practical skills and demonstration of ability to apply it in real-world settings.	Reflective thinking
PO8	An ability to engage in independent and life-long learning through openness, curiosity, and a desire to meet new challenges.	Life-long learning
PO9	A capacity to relate, collaborate, and lead others, and to exchange views and ideas to work in a team to achieve desired outcomes	Teamwork
PO10	An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Leadership
PO11	An ability to understanding values, ethics, and morality in a multidisciplinary context.	Moral and ethical awareness

**PREAMBLE OF THE SYLLABUS:**

The ongoing B.Sc. (CBCGS) Zoology course was introduced by the Faculty of Sciences from the academic year 2022-2023. The new course of F.Y.B.Sc. Zoology that will be effective from the academic year 2019- 2020, will follow the Semester mode. It has been prepared keeping in view the unique requirements of B.Sc. (CBCGS) Zoology students. The syllabus has been drawn up to introduction of the classical zoology with accommodation of widening horizons of the discipline of Biological Sciences. The Board of Studies examined the existing syllabus and after analysing with respective subjects in term of content relevance, quality and pattern of teaching along with examination in present scenario. With the holistic approach the syllabus including basic as well as advanced concepts in Zoology from first year to 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.

**Semester - I**  
**[Under CBCS Scheme]**

Course	Course Type	Course code	Hrs/ week	Internal assessment	Semester-end examination	Total	Credits
Chemistry 1	Core		3	40	60	100	2
Chemistry 2	Core		3	40	60	100	2
Physics1	Core		3	40	60	100	2
Physics 2	Core		3	40	60	100	2
Mathematics1	Core		3	40	60	100	2
Mathematics 2	Core		3	40	60	100	2
Microbiology 1	Core		3	40	60	100	2
Microbiology 2	Core		3	40	60	100	2
Zoology 1	Core		3	40	60	100	2
Zoology 2	Core		3	40	60	100	2
Botany 1	Core		3	40	60	100	2
Botany 2	Core		3	40	60	100	2
Foundation Course/ Foundation course in PE/NSS/ NCC	Skill enhancement		3	40	60	100	2
Environmental Science	Ability enhancement		2	40	60	100	2
Chemistry Practical	Core		6	--	100	100	2
Physics Practical	Core		6	--	100	100	2
Mathematics Practical	Core		3	--	100	100	2
Microbiology Practical	Core		6	--	100	100	2
Zoology Practical	Core		6	--	100	100	2
Botany Practical	Core		6	--	100	100	2

**Semester - II**  
**[Under CBCS Scheme]**

Course	Course Type	Course code	Hrs/week	Internal assessment	Semester-end examination	Total	Credits
Chemistry 1	Core		3	40	60	100	2
Chemistry 2	Core		3	40	60	100	2
Physics1	Core		3	40	60	100	2
Physics 2	Core		3	40	60	100	2
Mathematics1	Core		3	40	60	100	2
Mathematics 2	Core		3	40	60	100	2
Microbiology 1	Core		3	40	60	100	2
Microbiology 2	Core		3	40	60	100	2
Zoology 1	Core		3	40	60	100	2
Zoology 2	Core		3	40	60	100	2
Botany 1	Core		3	40	60	100	2
Botany 2	Core		3	40	60	100	2
Foundation Course/ Foundation course in PE/NSS/ NCC	Skill enhancement		3	40	60	100	2
Communication Skill	Ability enhancement		2	40	60	100	2
Chemistry Practical	Core		6	--	100	100	2
Physics Practical	Core		6	--	100	100	2
Mathematics Practical	Core		6	--	100	100	2
Microbiology Practical	Core		6	--	100	100	2
Zoology Practical	Core		6	--	100	100	2
Botany Practical	Core		6	--	100	100	2

<b>Course Description</b>	
<b>Semester</b>	<b>I &amp; II</b>
<b>Course Name</b>	<b>Zoology</b>
<b>Course Code</b>	<b>USCZ1P/ USCZ2P</b>
<b>Eligibility for the Course</b>	<b>12<sup>th</sup> Science passed</b>
<b>Credit</b>	<b>6</b>
<b>Hours</b>	<b>90 Hrs</b>

**Scheme of Examination  
Faculty of Science  
(Undergraduate Programmes)**

**Choice Based Credit System (CBCS)**➤ **Revised Scheme of Examination**

The performance of the learners shall be evaluated into two components. The learner's Performance shall be assessed by Internal Assessment with 40% marks in the first component by conducting the Semester End Examinations with 60% marks in the second component. The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below: -

**A) Internal Assessment: 40 %****40 Marks**

Sr. No.	Particular	Marks
01	One periodical class test / online examination to be conducted in the given semester	20 Marks
02	Any two tools out of these (10 Marks each) 1. Group/ Individual Project 2. Presentation and write up on the selected topics of the subjects / Case studies. 3. Test on Practical Skills 4. Quiz	20 Marks

**Question Paper Pattern**

**(Periodical Class Test/ online examination for the Courses at Under Graduate Programmes)**

- ❖ Maximum Marks: 20
- ❖ Duration: 30 Minutes

Particular	Marks
Match the Column / Fill in the Blanks / Multiple Choice Questions/ True/False/Answer in One or Two Lines (Concept based Questions) (1 Marks each)	20 Marks

**B) Semester End Examination: 60 %**

**60 Marks**

➤ **Undergraduate Programmes of F. Y. B.Sc. (Sem. I & II) and S. Y. B.Sc. (Sem. III & IV)**

- Duration: The examination shall be of 2 hours duration.

**Question Paper Pattern**

**Theory question paper pattern**

1. There shall be four questions of 15 marks each (30 marks with internal options).
2. On each unit there will be one question and fourth question will be based on entire syllabus.
3. All questions shall be compulsory with internal options.
4. Question may be subdivided into sub-questions a, b, c... and the allocation of marks depends on the weightage of the unit.

➤ **Undergraduate Programmes of T. Y. B.Sc. (Sem. V & VI)**

- Duration: The examination shall be of 2 hours duration.

**Question Paper Pattern**

**Theory question paper pattern**

1. There shall be five questions each of 12 marks (24 marks with internal options).
2. On each unit there will be one question and fifth question will be based on entire syllabus.
3. All questions shall be compulsory with internal options.
4. Question may be subdivided into sub-questions a, b, c... and the allocation of marks depends on the weightage of the unit.

➤ **Passing Standard**

The learners to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment and Semester End Examination. The learners shall obtain minimum of 40% marks (i.e. 16 out of 40) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 24 Out of 60) separately, to pass the course and minimum of Grade D, wherever applicable, to pass a particular semester. A learner will be said to have passed the course if the learner passes the Internal Assessment and Semester End Examination together.



➤ **Evaluation pattern of the project work (50 Marks)**

Student would undertake a project for 1-2 months during the semester.

Sr. No.	Particular	Marks
01	Project	50 Marks
	Documentation	25 Marks
	Presentation	15 Marks
	Viva	10 Marks

- ***The plagiarism should be maintained as per the UGC guidelines.***

Note: As per previous ordinance there will not be any internal examination for practical.

**Note: 1) It is noted that the concerned regulation of the College is amended and implemented to all Semesters i.e. Semester I to Semester VI to all undergraduate programmes, under faculty of Arts, Commerce and Science with effect from the academic year 2022 - 2023.**

**2) This revised scheme of evaluation is discussed in detail, finalised and accepted**

### Question Paper Pattern for Semester End Examination

I	<b>Theory: 60 Marks</b>	
	Each theory paper shall be of two-hour duration.	
	All questions are compulsory and will have internal options.	
	Q-1	From Unit – I (having internal options.) 15 M
	Q-2	From Unit – II (having internal options.) 15 M
	Q-3	From Unit – III (having internal options.) 15M
	Q-4	Questions from all the THREE Units with equal weightage of marks Allotted to each Unit. 15 M

### Question Paper Pattern for Continuous Assessment (Total Marks 20 to be converted in 10 marks)

Marks	Group Project*/ Individual Project	Presentation and write-up	Practical Skills	Open book test	Quiz
5	Hypothesis/Topic of the project	Presentation skill	Demonstration of skill	<b>High order thinking questions (HOTS)</b>	<b>Quiz on application of subject in real life</b>
5	Actual laboratory work/Field work	Knowledge	Viva		
5	Result/output	Quality of ppt	Report		
5	Dissertation/Report	Writing skill	Problem solving ability		

#### Note

#### Group Project\*

- 1) Define number of students
- 2) Every student will get equal marks if the same contribution
- 3) if any student without any kind of involvement in the project, guide will take the decision on his share

**Question Paper Pattern for Practical Examination**

II	Practical	The External examination per practical course will be conducted as per the Following scheme.
<b>Sr. No.</b>	<b>Particulars of External Practical Examination</b>	<b>Marks</b>
1.	Laboratory Work	35+35 = 70
2.	Field visit and report	05+05= 10
3.	Journal	05+05 = 10
4.	Viva	05+05 = 10
	<b>TOTAL</b>	<b>100</b>

**Choice Based Credit Grading and Semester System (CBCGS)**  
**F.Y.B. Sc. Course – ZOOLOGY**  
**To be implemented from the Academic year 2022-2023**  
**SEMESTER I**

COURSE CODE	UNIT	TOPICS	CREDITS	LECTURES/WEEK
USC1Z01	I	Diversity in Non-chordates	2	1
	II	Animal Diversity- Non chordates		1
	III	Type study- Earthworm		1
USC1Z02	I	Introduction of Cell	2	1
	II	Structure and function of cell		1
	III	Tools and Techniques in cell biology		1
USC1Z0P	Practical based on both courses		2	6

**SEMESTER II**

COURSE CODE	UNIT	TOPICS	CREDITS	LECTURES/WEEK
USZ0201	I	Animal Diversity in chordates	2	1
	II	Group Eurochordata		1
	III	Type study- Shark		1
USZ0202	I	Mendelian Inheritance	2	1
	II	Sex determination and Sex linkage		1
	III	Basics of linkage and crossing over		1
USZ0P2	Practical based on both courses		2	6

**SYLLABUS F.Y.B.Sc. ZOOLOGY**  
**UNIT WISE DISTRIBUTION**

<b>Semester I</b>		<b>Semester II</b>	
<b>Core Course 1</b>	<b>Core Course 2</b>	<b>Core Course 3</b>	<b>Core Course 4</b>
<b>Unit 1</b> Diversity of animal Kingdom I	<b>Unit 1</b> Introduction of Cell	<b>Unit 1</b> Animal Diversity in chordates	<b>Unit 1</b> Mendelian Inheritance
<b>Unit 2</b> Animal Diversity- Non chordates	<b>Unit 2</b> Structure and function of cell	<b>Unit 2</b> Group Eurochordata	<b>Unit 2</b> Sex determination and Sex linkage
<b>Unit 3</b> Type study- Earthworm	<b>Unit 3</b> Tools and Techniques in cell biology	<b>Unit 3</b> Tools and Techniques in cell biology	<b>Unit 3</b> Basics of linkage and crossing over
<b>Practical</b> (USC1ZOP)	<b>Practical</b> (USC1ZOP)	<b>Practical</b> (USC2ZOP)	<b>Practical</b> (USC2ZOP)

**Syllabus for F.Y.B.Sc.  
Program: B.Sc.  
Course: ZOOLOGY  
Semester I  
Paper I and Practical I**

**F.Y.B.Sc. ZOOLOGY (THEORY)**

**SEMESTER I**

**Course Code: USCZ1P01**

**Course I: Diversity in Non-chordates**

**Credit 2**

**Course Objectives:**

- To nurture interest in the students for the subject of Zoology.
- To understand animal diversity.
- To study detailed morphology of invertebrates.

**Course Outcomes**

- Learners will be able to comprehend the diversity of animals.
- Learners will be able to understand the importance of classification.
- Learners develop insight of particular group and type study.

**Unit I: Diversity of animal Kingdom I**

**(15 Lectures)**

**1.1: Levels of organization**

**1.1.1:** Unicellularity Vs multicellularity, Colonization and organization of germ layers (diploblastic and triploblastic condition)

**1.1.2:** Division of labour and organization of tissues (Brief fate of ectoderm, mesoderm and endoderm)

**1.1.3:** Development of coelom: Acoelomate, pseudocoelomate and coelomate organization

**1.1.4:** Radial and bilateral symmetry

**1.1.5:** Metamerism

**1.2: Unicellular and multicellular organization**

(Salient features with examples of phyla, subphyla and classes mentioned below)

**1.2.1:** Unicellular organization: Phylum Protozoa

**1.2.2:** Multicellular organization: Colonization level- Phylum Porifera

**1.2.3:** Multicellular organization: Division of labour (Cell differentiation)- Phylum Coelenterata

**1.3 Triploblastic acoelomate and pseudocoelomate organization**

**1.3.1:** Acoelomate organization - Phylum Platyhelminthes

**1.3.2:** Pseudocoelomate organization – Phylum Nematelminths

**1.4: Triploblastic coelomate organization**

**1.4.1:** Animals with metameric segmentation- Phylum Annelida

**1.4.2:** Animals with jointed appendages- Phylum Arthropoda

**Unit II: Animal Diversity- Non chordates**

**(15 Lectures)**

**2.1 Non-Chordates:** General characters and classification of the following up to classes with examples showing distinctive / adaptive features of the following phyla:

**2.1.1:** Kingdom Protista: Protozoa (*Amoeba*, *Paramecium*, *Euglena*, *Plasmodium*)

**2.2: Kingdom Animalia**

**2.2.1:** Porifera (*Leucosolenia*, *Euplactella*, *Hyalonema*, *Euspongia*)

**2.2.2:** Coelenterata (Cnidaria) (*Physalia*, *Obelia*, *Aurelia*, sea Anemone)

**2.2.3:** Ctenophora (Comb jelly)

**2.2.4:** Platyhelminthes (*Fasciola*, *Planaria*, Liverfluke, Tapeworm)

**2.2.5:** Nematohelminthes (*Ascaris*, *Ancylostoma*, *Enterobius*)

**2.2.6:** Annelida (*Nereis*, Earthworm, Leech)

**2.2.7:** Arthropoda (Crab, Lobster, Beetle, Dragonfly, Butterfly, Moth, Spider, Centipede, Millipede)

**2.2.8:** Mollusca (*Chiton*, *Dentalium*, *Pila*, *Unio*, *Sepia* and *Nautilus*)

**2.2.9:** Echinodermata (Starfish, Brittle star, Sea urchin, Sea cucumber, Feather star)

**2.2. General topics: Economic importance of Protozoa**

**Unit III: Type study- Earthworm:**

**(15 Lectures)**

Systematic position, Habits and habitat, External characters, Body wall, Digestive system, Blood Vascular System, Excretory system, Nervous system and sense organs. Reproductive system, Economic importance



**SEMESTER I**

**Practical Code: USCZ1P**

**PRACTICAL – I**

**1. Study of levels of organization in Animal kingdom**

A) Symmetry:

- i) Asymmetric organization: Amoeba
- ii) Radial symmetry: Sea anemone, Aurelia
- iii) Bilateral symmetry: Planaria / liver fluke

B) Acoelomate: T.S. of Planaria / liver fluke

C) Pseudocoelomate: T.S. of Ascaris

D) Coelomate: T.S. of Earthworm

E) Segmentation

- i) Pseudosegmentation: Tapeworm
- ii) Metamerism: Earthworm

F) Specialization of body parts for division of labour: Head, thorax and abdomen - Insect

G) Cephalization

- i) Cockroach – Head
- ii) Prawn/ crab – Cephalothorax

**2. Study of animal diversity with reference to-**

- i) Protozoa: Amoeba, Paramecium, Euglena, Plasmodium
- ii) Porifera: Leucosolenia, bath sponge
- iii) Coelenterate: Hydra, obelia colony, Aurelia, sea anemone and any one coral
- iv) Platyhelminthes: Planaria, liver fluke and tapeworm
- v) Nematelminths: Ascaris- male and female
- vi) Annelida: Nereis, earthworm and leech
- vii) Arthropoda: Crab, lobster, Lepisma, beetle, dragonfly, butterfly, moth, spider, centipede, millipede

**3. Preparation and observation of Paramecium.**

**4. Determination of the rate of heart beat in Daphnia and population density (Daphnia or any suitable organism) by sub sampling method.**

**5. Study of animal interaction:**

- Commensalism: Echinus and shark
- Mutualism: Termite and Trichonympha

- Antibiosis: Effect of antibiotic on bacterial growth on a petri plate
  - Parasitism: Ectoparasite – head louse and bed bug
  - Endoparasite: *Trichinella spiralis*
  - Predation: Praying mantis and spider
6. Demonstration of systems/ organs in Earthworm: Digestive system, Excretory system, Reproductive system and Nervous system (Use of permanent slide, model or photographs)
  7. Study of life cycle and pathogenicity of *Entamoeba*, *Leishmania*, liver fluke and Tapeworm
  8. Study of any 5 invertebrates available in nearby area (Submit the project)

**REFERENCES AND ADDITIONAL READING**

1. Invertebrate Zoology Volume II- Jordan and Verma , S. Chand and Co.
2. Invertebrate Zoology- T. C. Majumuria , S. Nagin and Co.
3. Invertebrate Zoology- P. S. Dhami and J. K. Dhami , R. Chand and Co.
4. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill
5. Modern Textbook of Zoology, Invertebrates, R. L. Kotpal
6. Biodiversity- S.V.S Rana- Prentice Hall Publications
7. Modern Biology- V. B. Rastogi
8. Biology of Mollusca- D. R. Khanna
9. A Textbook of Zoology, Vol. II- T. Jeffery Parker and William. A. Haswell- Low Price Publications.
10. Manuals of Laboratory Specimens Invertebrates Gurudarshan Singh

**Syllabus for F.Y.B.Sc.  
Program: B.Sc.  
Course: ZOOLOGY  
Semester I  
Paper II and Practical II**

**F.Y.B.Sc. ZOOLOGY (THEORY)**  
**SEMESTER I**  
**Course Code: USC1ZO2**  
**Course -II Fundamentals of Cell biology**

**Credit 2**

**Course Objectives:**

- To study the cell as a basic unit of life and its different types
- To understand cell structure and function
- To study basic techniques used in cell biology

**Course outcome:**

- The learners can describe cell as structural and functional unit of life
- Learners will differentiate prokaryotic and eukaryotic cell and role of various cell organelles.
- Students are well known about use of techniques in cell biology.

**Unit I: Introduction of Cell**

**(15 Lectures)**

**1.1: The Cell**

**1.1.1.** Introduction and History of cell Biology

**1.1.2.** Study of prokaryotic and eukaryotic cell

**1.1.3.** Scope of cell biology

**1.2 : Organization of cell**

**1.3: Extranuclear**

**1.3.1.** Structure and composition cell cytoplasm and cytoplasmic organelles.

**1.3.2.** Structure and functions of mitochondria, Endoplasmic reticulum, lysosomes, Golgi complex and nucleus

**Unit II: Structure and function of cell membrane:**

**(15 Lectures)**

**2.1.** Cell membrane organization

**2.2.** Cell membrane:

**2.2.1.** Chemical composition

**2.2.2.** Fluid mosaic model

**2.2.3.** Functions of plasma membrane

**Unit III: Tools and Techniques in cell biology**

**(15 Lectures)**

**3.1.** Microscopy

➤ Light microscopy

➤ Electron microscopy

**3.2.** Cytochemical stains

**3.3.** Cell fractionation

**3.4.** Chromatography -paper chromatography

**SEMESTER I**  
**Practical code: USC1ZOP**  
**Course I**

1. Study of Microscopy: Simple, Compound and Phase contrast
2. Study of prokaryotic and eukaryotic cell types with the help of chart, slide and video.
3. Observation of Prokaryotic and eukaryotic cell by simple staining
4. Study of mitosis from onion root tip/ bone marrow.
5. Study of meiosis from onion flowers/grasshopper testis.
6. Isolation of DNA from the liver tissue.
7. Detection of mitochondria by Janus green B using onion.
8. Study of membrane permeability of RBC using saline solution.
9. Project work.

**REFERENCES AND ADDITIONAL READING**

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – Verma, Agarwal – S. Chand & Co.
2. Molecular & Cell Biology – Bhamrah – Anmol Publ. Pvt. Ltd., New Delhi.
3. Molecular Biology of the Cell – Alberts, Bray, Lewis, Raff, Roberts, Watson – Garland Publishers, New York.
4. Molecular Biology of the gene – J. D. Watson, NH Hopkins, Roberts, Stertz, Weiner-Freeman.
5. Molecular Biology of the Gene – Watson, Hopkins, Roberts, Steitz, Weiner – Benjamin Cummings Publishing Co.
6. Molecular Cell Biology – Baltimore, Zipursky, Matsudaria, Darnel – W. H. Freeman & Co., New York.
7. Principles of Biochemistry – White, Handler, Smith – McGraw Hill Publ. 18) Cell & Molecular Biology – Phillip Sheller – Wiley Publ.
8. Lehninger Principles of Biochemistry -David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.



**Syllabus for F.Y.B.Sc.  
Program: B.Sc.  
Course: ZOOLOGY  
Semester II  
Paper I and Practical I**

**F.Y.B.Sc. ZOOLOGY (THEORY)**  
**Course Code: USC2ZO1**  
**SEMESTER II Paper I**  
**Course III: Diversity in Chordates**

**Credit 2**

**Course Objectives:**

- To nurture interest in the students for the subject of Zoology.
- To understand animal diversity.
- To study detailed morphology of chordates

**Course Outcomes:**

- Learners will be able to comprehend the diversity of animals.
- Learners will be able to understand the importance of classification.
- Learners develop insight of particular group and type study.

**Unit I: Animal Diversity in chordates**

**(15 Lectures)**

**1.1: Phylum Chordata:**

**1.1.1.** General characters and classification of Chordata.

**1.1.2.** Difference between Chordates and non-chordates.

**1.1.3.** Affinities of Balanoglossus

**1.2: Group Protochordata:**

**1.2.1.** Subphylum Hemichordata e.g., Balanoglossus

**1.2.2:** Subphylum Urochordata e.g., Herdmania

**1.2.3:** General characters of Ascidian

**1.2.4:** Retrogressive Metamorphosis in Ascidian

**1.2.5:** Subphylum Cephalochordata e.g., Amphioxus

**Unit II: Group Eurochordata**

**(15 Lectures)**

**2.1: Division: Agnatha**

**2.1.1:** Class Ostracodermi

**2.1.2:** Class Cyclostomata

**1.1.3:** Division: Gnathostomata

**1.1.3.1:** Superclass Pisces (Cartilaginous and bony fish)

➤ Class Chondrichthyes

➤ Class Osteichthyes

**1.1.3.2:** Superclass Tetrapoda

- Class Amphibia
- Class Reptilia
- Class Aves
- Class Mammalia

**Unit III: Type study- Shark:**

**(15 Lectures)**

- 3.1.** Systematic position, Habits and habitat
- 3.2.** External characters
- 3.3.** Digestive system
- 3.4.** Circulatory system
- 3.5.** Excretory system
- 3.6.** Reproductive system
- 3.7.** Nervous system and sense organs

**SEMESTER II PAPER I**  
**Practical code: USC2ZOP**  
**Practical I**

1. Study of museum specimen of *Herdmania*, *Petromyzon* (Sea lamprey) and *Myxine* (Hagfish)
2. Study of permanent slide of *Amphioxus* and *Balanoglossus*.
3. Study of classification and morphological characteristics of vertebrates
  - i. Superclass Pisces: Shark (*Scoliodon*), Skate (*Rhinobatys*), Sting ray (*Dasiatias*), Electric ray, Sciana, Flying fish, Tilapia
  - ii. Class Amphibia: Frog, toad
  - iii. Class Reptilia: Chameleon, Calotes, Turtle, Cobra
  - iv. Class Aves: Duck, Kingfisher, Parakeet
  - v. Class Mammalia: Bat, Shrew
4. Study of External morphology of *Scoliodon* (Demonstration).
5. Study of Digestive system of *Scoliodon* (Demonstration).
6. Study of Circulatory system of *Scoliodon* (Demonstration).
7. Study of Reproductive system of *Scoliodon* (Demonstration).
8. Study of Nervous system (Brain and Cranial Nerves) of *Scoliodon* (Demonstration).
9. Mounting of scales of fish (Placoid, Cycloid, Ctenoid)
10. Visit to forest/ wildlife sanctuary/ biodiversity park/ museum and preparation of field visit report.

**REFERENCES AND ADDITIONAL READING**

1. Vertebrate Zoology Volume I- Jordan and Verma, S. Chand and Co.
2. Chordate Zoology- P. S. Dhami and J. K. Dhami , R. Chand and Co.
3. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition
4. Zoology- S. A. Miller and J. B. Harley, Tata McGraw Hill
5. Modern Textbook of Zoology, Invertebrates, R. L. Kotpal
6. A Textbook of Zoology, Vol. II- T. Jeffery Parker and William. A. Haswell- Low Price Publications
7. Animal Behavior: Mechanisms, Ecology and Evolution Stephen Vessey, Elizabeth Jacob, S. H. Vessey and L. C. Drickamer, McGraw-Hill.
8. An introduction to Animal Behaviour- Manning and Dawkins
9. Animal Behaviour-Agarwal
10. Principles of Animal Communication. Bradbury, J.W. and S.L. Vehrencamp. Sinauer Assoc. Sunderland, Massachsets, USA.
11. The biology of Behaviour. Eibl-Eibesfeldt, I. Ethology. Holt, Rineheart & Winston, New York.

**Syllabus for F.Y.B.Sc.  
Program: B.Sc.  
Course: ZOOLOGY  
Semester II  
Paper II and Practical II**

**F.Y.B.Sc. ZOOLOGY (THEORY)**

**SEMESTER II**

**Course Code: USC2ZO2**

**Course IV: Fundamentals of Genetics**

**Credit 2**

**Course Objectives:**

- To introduce the learners about basic concepts of genetics and
- To correlate Application of genetics in day-to-day life.
- To understand the basic concept of DNA, Gene and genome organization

**Course Outcomes**

- Learners will be able to understand the basic concepts of genetics.
- Learners will be able to understand recombination and interaction of Genes
- Learners will appreciate impact of genetics on diversity of animals.

**Unit I: Mendelian Inheritance**

**(15 Lectures)**

**1.1.** Genetics: scope and importance.

**1.2.** Elements of heredity and variation:

**1.2.1.** Classical and Modern concept of Gene (Cistron, muton, recon), Alleles etc.

**1.2.2.** Mendel's laws of inheritance

**1.2.3.** Chromosomal basis of inheritance and its applications

**1.3.** Exceptions to Mendelian Inheritance: Incomplete dominance, Codominance, Multiple allelism, Lethal alleles, Pleiotropy, Epistasis - Recessive, Double recessive and double dominant

**1.4.** Autosomal dominant and autosomal recessive, X-linked dominant, and X-linked recessive.

**Unit II: Sex determination and Sex linkage**

**(15 Lectures)**

**2.1.** Mechanism of Sex determination: XX/XO, XX/XY, ZZ/ZW

**2.2.** Multiple alleles

**2.3.** Genic balance theory, intersex, gynandromorphs.

**2.4.** Hormonal influence on sex determination-Freemartin and sex reversal.

**2.5.** Role of environmental factors- Bonellia and Crocodile.

**Unit III: Basics of linkage and crossing over**

**(15 Lecture)**

**3.1.** Basics of linkage and its types

**3.2.** Basics of crossing over and its type, Factors influencing crossing over

**3.3.** Chromosomal mapping

**F.Y.B.Sc. ZOOLOGY  
SEMESTER II  
PRACTICAL CODE: USC2ZOP**

1. Study of Human karyotypes
2. Study of monohybrid ratio/ dihybrid ratio.
3. Study of multiple alleles/ epistasis.
4. Study of inheritance patterns by pedigree analysis in human for autosome and sex chromosome.
5. Mounting of Barr bodies.
6. Identification of the following genetic traits in human: widow's peak, attached ear lobe, dimple in chin, hypertrichosis, colour blindness, Rolling of tongue, Dimple in cheek.
7. Study of ABO blood group system. (Experimental)
8. Survey project based on genetics.



**REFERENCE BOOKS AND ADDITIONAL READING**

1. Principles of Genetics. Gardner, E.J., Simmons, M.J and Snustad, D.P. John Wiley and Sons
2. Concepts of Genetics. Klug, W.S., Cummings M.R., Spencer, C.A. Benjamin Cummings.
3. Genetics- A Molecular Approach. Russell, P. J Benjamin Cummings.
4. Genetics: Analysis of Genes and Genomes. Daniel L., Hartl, Elizabeth W. Jones Jones & Bartlett Publishers
5. Introduction to Genetic Analysis. Griffiths, A.J.F., Wessler. S.R., Lewontin, R.C. and Carroll, S.B. W. H. Freeman and Co.
6. Cell Biology, Genetics, Molecular Biology Evolution and Ecology. Verma P.S. and Agrawal P.K., 9<sup>th</sup> edition, S. Chand Publication, New Delhi.
7. Principles of Genetics – Eight edition- Eldon John Gardner, Michael J. Simmons, D. Peter Snustad
8. Genetics- Weaver, Hedrick, third edition, Mc Graw Hill Education
9. Genetics A Mendelian approach Peter Russel, Pearson Benjamin Cummings
10. Genetics A conceptual approach, Benjamin A. Pierce, Southwestern University, W.H. Freeman and company, New York
11. Genetics, Third Edition, M o n r o e W. Strickberger
12. Genetics from gene to genome, third edition, Leeland H. Hartwell, Leeroy Hood, Michael 7. L. Goldberg, Ann E. Reynolds, Lee M. Silver, McGraw Hill Education

**N.B.**

I) It is pertinent to note that we have to adhere strictly to the directions as given in the UGC Circular F14-4/2006 (CPP-II).

II) Apart from the institutional Animal Ethics Committee (IAEC) and any other Committee appointed by a Competent Authority/Body from time to time, every college should constitute the following Committees:

- 1) A Committee for the Purpose of Care and Supervision of Experimental Animals (CPCSEA) and
- 2) A Dissection Monitoring Committee (DMC)

**Composition of DMC shall be as follows:**

- i) Head of the Concerned Department (Convener/Chairperson)
- ii) Two Senior Faculty Members of the concerned Department
- iii) One Faculty of related department from the same College
- iv) One or two members of related department from neighbouring colleges.