**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
।। विद्यया संपन्नता ।।

**NAAC Accredited-2015**
**'B' Grade (CGPA 2.62)**

# Name of the Faculty: Science & Technology

## CHOICE BASED CREDIT SYSTEM

# Syllabus: ZOOLOGY

## Name of the Course: B.Sc. I ( Sem–I & II )

**(To be effective from the academic year June-2019).**

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur,
## Faculty of Science
### Choice Based Credit System (CBCS)
### ( 2019 -2020 : W.e.f. June 2019)

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**Choice Based Credit System:** With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

· **Outline of Choice Based Credit System:**

1. ***Core Course:*** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. ***Elective Course:*** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

**Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. ***Ability Enhancement Courses (AEC):*** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC).** "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

· **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 20 marks and University Evaluation for 80 marks.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

## Faculty of Science

## Choice Based Credit System (CBCS),(w.e.f.2019-20) Structure for B. Sc-I Zoology

| Subject/ Core Course | Name and Type of the Paper | | No. of papers/ Practical | Hrs/week | | | Total Marks Per Paper | UA | CA | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Name | | L | T | P | | | | |
| **Class :** | **B.Sc.- I Semester – I** | | | | | | | | | |
| **Ability Enhancement Course(AECC)** | | English (communication skill) | Paper- I | 4.0 | | | 100 | 80 | 20 | 4.0 |
| **Core** (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.) | | DSC 1A | Paper-I | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-II | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | DSC 2A | Paper-I | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-II | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | DSC 3A | Paper-I | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-II | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | DSC 4A **Zoology -Animal Diversity I and II** | Paper-I **Animal Diversity I** | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-II **Animal Diversity II** | 2.5 | -- | -- | 50 | 40 | 10 | |
| **Total** | | | | **24** | -- | -- | **500** | **400** | **100** | **20** |
| **Class :** | **B.Sc.- I Semester - II** | | | | | | | | | |
| **Ability Enhancement Course(AECC)** | | English (Communication skill) | Paper- II | 4.0 | | | 100 | 80 | 20 | 4.0 |
| **Core** (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.) | | DSC 1B | Paper-III | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-IV | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | DSC 2B | Paper-III | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-IV | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | DSC 3B | Paper-III | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-IV | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | DSC 4B **Zoology-Comparative Anatomy and Developmental Biology of vertebrates** | Paper-III **Comparative Anatomy of vertebrates** | 2.5 | -- | -- | 50 | 40 | 10 | 4.0 |
| | | | Paper-IV **Developmental Biology of vertebrates** | 2.5 | -- | -- | 50 | 40 | 10 | |
| | | Democracy, Elections and Good Governance | | 3.0 | | | 50 | 40 | 10 | NC |
| **Total (Theory)** | | | | **27** | -- | -- | **550** | **440** | **110** | **20** |
| **Core** | | DSC 1 A & 1B | Practical I and II | -- | -- | 4 | 100 | 80 | 20 | 4.0 |
| | | DSC 2 A & 2B | Practical I and II | -- | -- | 4 | 100 | 80 | 20 | 4.0 |
| | | DSC 3A & 3B | Practical I and II | -- | -- | 4 | 100 | 80 | 20 | 4.0 |
| | | DSC 4A & 4B **Zoology** | Practical I and II | -- | -- | 4 | 100 | 80 | 20 | 4.0 |
| **Total (Practical)** | | | | | | **16** | **400** | **320** | **80** | **16** |
| **Grand Total** | | | | **51** | | **16** | **1450** | **1160** | **290** | **56** |

***Core Subjects**

**Chemistry/Physics/Electronics/Computer Science/Mathematics/Statistics/Botany/Zoology/ Microbiology/Geology/ Geography/Psychology**

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

**Faculty of Science**
**Choice Based Credit System (CBCS)**
**(W.e.f. June 2019)**

· **Title of the Course:** B.Sc. Part-I

· **Subject:** Zoology

· **Introduction:** This course provides a broad overview of Zoology and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using Zoology. The course structure is basic science centric where students learn core science and are taught necessary fundamental subject for that purpose.

· **Objectives of the course:** The objectives of B. Sc. Zoology course are:

a. To provide an intensive and in depth learning to the students in field of Zoology.
b. Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing world.
c. To develop awareness & knowledge of different organization requirement and subject knowledge through varied branches and research methodology in students.
d. To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

**Course outcome and Advantages :** Zoology has tremendous job potential.

a) The successful students will be able to establish research organizations with the help of agriculture, environment protection and also their own industry for transgenic animals, clinical pathology, genetic counseling, human karyotyping etc.
b) Scientific Research Organizations.
c) Universities in India & aboard.
d)

· **Eligibility and Admission:** A Candidate passing 10+2 with biology MLT , dairy science , Fisheries, Agricultural science as one of the subject and passed from state syllabus / CBSE / equivalent with minimum passing percentage of as per the directives of the higher education and Solapur university, Solapur.

· **Duration:** The duration for this program is of 3 years with semester pattern (06 Semesters)

· **Medium of Instruction:** English

· **Syllabus Structure:**

· The University follows semester system.
· An academic year shall consist of two semesters.
· Each B.Sc. course shall consist of three years i.e. six semesters.
· B.Sc. Part-I Zoology shall consist of two semesters: Semester I and Semester II.

In semester I, there will be two core papers is having paper I and paper II of 100 marks. Similarly in Semester II there will be two core papers is having paper I and paper II of 100 marks. English will be as Ability Enhancement Course (AECC) in both Semester I and II. English paper carries 100 marks in each semester.

The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment as given below. For B.Sc. Part-I Zoology sem I & II the internal assessment will be based on Internal tests, Home assignment, Tutorials, Seminars, Group discussion, Brain storming sessions etc. as

given below. Practical course examination is of 100 marks shall be conducted at the end of semester II. The practical examination of 100 marks shall also consist of 80 marks for University practical assessment and 20 marks for college internal assessment.

· **Scheme of Evaluation**

As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 20 marks and external evaluation (University assessment) of 20 marks.

**Semester – I:**

**Theory: (100 marks)**

University Examination (80 marks): No. of theory papers: 2 (paper I and paper II of 40 marks each )

**Internal Continuous Assessment: (20 marks and 10 marks each for two papers )**

(a) Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.

**Semester – II**

**Theory: (100 marks)**

University Examination (80 marks): No. of theory papers: 2 (paper III and paper IV of 40 marks each)

**Internal Continuous Assessment: (20 marks and 10 marks each for two papers)**

(a) Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.

**Practical Examination: (100 marks)**

University Examination (80 marks): No. of practical course: 1

**Internal Continuous Assessment: (20 marks)**

(a) Internal practical test - Scheme of marking: **10 marks**

(b) Viva/group discussion/model or chart/attitude/attendance/overall behavior: **10 marks**

**Passing Standard**

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade. Such student will have to reappear for University Examination only. A student who fails in internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment. In case of Annual pattern/old semester pattern students/candidates from the mark scheme the candidates shall appear for the same 70 marks of external examination and his performance shall be scaled to 100 marks.

· **ATKT**

Candidate passed in all papers, except **5 (five)** papers combined together of semester I and II of B.Sc. Part-I Zoology examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Zoology

# B.Sc .I Semester-I & II, ZOOLOGY
# Choice Based Credit System (CBCS) Structure (2019-20)

## Semester- I (Theory)

| Paper | Title | Marks |
|---|---|---|
| I | Animal diversity-I ( Paper I ) | 50 (40- UA and 10-CA) |
| II | Animal diversity-II (Paper II) | 50 (40- UA and 10-CA) |

### Semester- II (Theory)

| Paper | Title | Marks |
|---|---|---|
| III | Comparative Anatomy of vertebrates ( Paper III ) | 50 (40- UA and 10-CA) |
| IV | Developmental Biology of vertebrates (Paper IV) | 50 (40- UA and 10-CA) |

### PRACTICAL AT THE END OF SEMESTER-II

| PRACTICAL | Title | Marks |
|---|---|---|
| I | Animal diversity I & II AND Comparative Anatomy of vertebrates and Developmental Biology of vertebrates | 100 (80 UA+20 CA) |

## SEMESTER – I

**CORE COURSE- I-** **(Total credits: 4)**

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**PAPER I: Animal Diversity- I**
**(Total credits 2.0, Contact Hrs 30.0)**

**Unit 1: Kingdom Protista** **3**
General characters and classification up to classes; locomotory organelle and locomotion in protozoa ,nutrition in protozoa.

**Unit 2: Phylum Porifera** **3**
General characters and classification up to classes; canal system in *Sycon*

**Unit 3: Phylum Cnidaria** **3**
General characters and classification up to classes; polymorphism in hydrozoa

**Unit 4: Phylum Platyhelminthes** **3**
General characters and classification up to classes; life history of *Taenia solium*

**Unit 5: Phylum Nemathelminthes** **4**
General characters and classification up to classes; life history of *Ascaris lumbricoides* and its parasitic adaptations

**Unit 6: Phylum Annelida** **3**
General characters and classification up to classes; metamerism in annelid, economic importance of annelids with reference to earthworm and leech

**Unit 7: Phylum Arthropoda** **4**
General characters and classification up to classes; vision in arthropoda, metamorphosis in insects, economic importance of insects.

**Unit 8: Phylum Mollusca** **3**
General characters and classification up to classes; torsion in gastropods
economic importance of molluscs

**Unit 9: Phylum Echinodermata** **4**
General characters and classification up to classes; water-vascular system in Asteroidea

Total- **30**

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**PAPER II: Animal Diversity- II**
**(Total credits 2.0, Contact Hrs 30.0)**

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**Unit 1: Protochordates** **3**
General features and phylogeny of protochordata

**Unit 2: Agnatha** **3**
General features of agnatha and classification of cyclostomes up to classes

**Unit 3: Pisces** **4**
General features and classification up to orders; economic importance of fishes

**Unit 4: Amphibia** **5**
General features and classification up to orders; parental care

**Unit 5: Reptiles** **5**
General features and classification up to orders; poisonous and non-poisonous snakes, types of snake venom, symptoms and treatments of snake bite

**Unit 6: Aves** **5**
General features and classification up to orders; flight adaptations in birds

**Unit 7: Mammals** **5**
General features and classification up to orders; adaptive radiation in mammals

**Total -30**

**References:**


- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.

- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.

- Pough H. *Vertebrate life*, VIII Edition, Pearson International.

- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

# SEMESTER – II

## CORE COURSE II- (Total credits: 4)

### PAPER III: COMPARATIVE ANATOMY OF VERTEBRATES
**(Total credits 2.0, Contact Hrs 30.0)**

**Unit 1: Integumentary System** **4**
Derivatives of integument with reference to glands and digital tips

**Unit 2: Skeletal System** **4**
Appendicular and axial skeleton in vertebrates

**Unit 3: Digestive System** **5**
Brief account of alimentary canal and digestive glands

**Unit 4: Respiratory System** **5**
Brief account of skin, gills, lungs, air sacs and swim bladder

**Unit 5: Circulatory System** **4**
Evolution of heart and aortic arches

**Unit 6: Urinogenital System** **4**
Succession of kidney, Evolution of urinogenital ducts

**Unit 7: Nervous System** **4**
Comparative account of brain

**Total - 30**

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## PAPER IV: DEVELOPMENTAL BIOLOGY OF VERTEBRATES

**(Total credits 2.0, Contact Hrs 30.0)**

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**Unit-I: Gametogenesis:** **03**

(a) Spermatogenesis and oogenesis with reference to mammals
(b) Vitellogenesis in birds and structure of hens egg

**Unit-II: Fertilization** **03**

(a) External fertilization in amphibians
(b) Internal fertilization in mammals
(c) General mechanism of fertilization in mammals

**Unit-III: Early Embryonic Development up to Gastrulation** **05**

(a) Cleavage, blastulation and gastrulation in frog
(b) Cleavage, blastulation and gastrulation in human
(c) Fate map of blastula in frog and human

**Unit-IV: Placenta in mammal** **04**

(a) Implantation of blastocyst in humans, human placenta and functions
(b) Types of placenta on the basis of histology

**Unit-V: Development and its Regulation** **05**

(a) Cellular differentiation: Definition, mechanism of differentiation
(b) Cellular movements: Epiboly, emboly and its significance in development
(c) Apoptosis: Definition, general mechanism and significance

**Unit-VI: General Topics in Embryology** **05**

(a) Metamorphosis in frog tadpole and its hormonal regulation
(b) Types of twins in human

**Unit-VII: Recent Developments in Human Embryology** **05**

(a) Principles and applications of ultrasound
(b) Causes of miscarriages

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**REFERENCES:**


- 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 and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
- Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.

# Practical Course in Zoology for B. Sc. I

**For both Semester I and II**

**(Credits 4)**

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**1.** Study of the following specimens (General characters and classification)
**CD/Model/Chart/Slides/Virtual**

- *Amoeba, Euglena, Plasmodium, Paramecium*
- *Sycon, Hyalonema, and Euplectella*
- *Obelia, Physalia, Aurelia, Metridium*
- *Taenia,, Ascaris, Fasciola*
- *Aphrodite, Nereis, Pheretima, Hirudinaria*
- *Peripatus, Palaemon, Crab, Limulus, Scolopendra, Julus, Periplaneta*
- *Chiton, Dentalium, Pila, Unio, Sepia, Octopus*
- *Pentaceros, Ophiura, Echinus, Cucumaria and Antedon,*
- *Balanoglossus, Herdmania, Branchiostoma*
- *Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla*
- *Ichthyophis, Salamandra, Bufo, Hyla*
- *Chelone,Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis*
- **Any six** common birds from different orders:
- *Ornithorhynchus, Pteropus, Rattus, Loris, Funambulus*

**2.** Study of the following permanent slides/lab.specimens:

(a) T.S. and L.S. of *Sycon*,
(b) *Taenia*- Scolex, mature & gravid proglottid
(c) Whole mount of male and female *Ascaris* and Liverfluke
(d) Observation and identification of protozoans, helminthes, arthropod vectors

**3.** Key for Identification of poisonous and non-poisonous snakes: Cobra & Rat Snake

(An "**animal album**" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.)

**4 . Osteology**: **CD/Model/Chart/Slides/Virtual CD**

a) Disarticulated skeleton of frog: Skull, Atlas, Typical Vertebra, Pectoral and Pelvic Girdle
b) Study of mammalian skulls: One herbivorous and one carnivorous animal

**5. Frog** - Study of developmental stages - whole mounts and sections through permanent slides – cleavage, blastula, gastrula, tadpole external and internal gill stages. **(CD/Model/Chart/Slides/Virtual CD)**

**6. Chick Embryology:** Study of chick egg and W.M. of embryonic stages: 24hrs, 33hrs, 48hrs, 72 hrs.

**6 Placenta:** Study of the different types of mammalian **placenta**- histological sections using permanent slides or Intact placenta of Rat / Human using laboratory material / photomicrographs./ **CD/Model/Chart/Slides/Virtual CD**

**7.** Examination of **gametes -** frog/rat - sperm and ova through permanent slides or photomicrographs./ **CD/Model/Chart/Slides/Virtual CD**

**8. Cytological Preparation:**

(a) Stained preparation of mitochondria using vital staining with suitable material
(b) Stained preparation of nucleus in blood smear using Leishman's stain
(c) Study of Osmosis: Effect of Isotonic, hypotonic and hypertonic solution on blood cells

**8) Study Tour /** – Visit to any suitable place of Zoological interest to study animal biodiversity / IVF and hospital Facility / Research Center and submission of report. **All necessary precautions must be taken while organizing study tour with reference to the safety of students.**

**(Or)**

A small project report or review article submission of any one topic related to any Ecological and Applied Zoological interest.

# Scheme of Marking for University Practical Examination

**Total Marks: 80**

| | | |
|---|---|---|
| Q.1. | Cytological preparation of mitochondria / nucleus **(any one)** | 10 |
| Q.2. | Effect of isotonic / hypotonic / hypertonic solution on blood cells **(any one)** | 10 |
| Q.3. | Spotting **(Five spots)**<br><br>(a) Identify & classify giving reasons<br>(b) Identify, sketch & label<br>(c) Identify & describe<br>(d) Identify & give evolutionary significance<br>(e) Identify & classify giving reasons | |
| Q.4. | Identification and explanation of mammalian placenta **(any one)** | 10 |
| Q.5. | Identification and explanation of:<br><br>(a) Any one bone: Identify, sketch & label<br>(b) Any one developmental stages of frog: Identify & explain<br>(c) Any one gamete of frog / rat: Identify, sketch & label<br>(d) Any one poisonous / non-poisonous snake: Identify & describe<br>(e) Any one of: canal system / parasite / W.M. of chick embryo: Identify & describe | 10 |
| Q.6. | Tour Report/ project report or review article submission | 10 |
| Q.7. | Laboratory Record (Journal) | 10 |
| Q8: | Viva –Voce (General) | 10 |

**B O S in Zoology**