Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
"B^{++}" Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ZOOLOGY

Name of the Course: B.Sc. III (Sem.–V & VI)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

B. Sc. -III Zoology **(W.e.f. June 2024)**

Background of Curriculum:

In accordance with the UGCs reference to standardize curricula at the national level and bring a match across all the Indian Universities, an attempt has been made to follow the pattern given in the UGCs Undergraduate Template.

Zoology deals with the study of animal kingdom specially the structural diversity, biology, embryology, evolution, habits and distribution of animals, both living and extinct. As it covers a fascinating range of topics, the modern zoologists need to have insight into many disciplines. The learning outcomes-based curriculum framework for a B.Sc. degree in Zoology is designed to cater to the needs of students in view of the evolving nature of animal science as a subject. The framework is expected to assist in the maintenance of the standard of Zoology degrees/programmes across the country by reviewing and revising a broad framework of agreed expected graduate attributes, qualification descriptors, programme learning outcomes and course-level learning outcomes. The framework, however, does not seek to bring about uniformity in syllabi for a programme of study in Zoology, or in teaching learning process and learning assessment procedures. Instead, the framework is intended to allow for flexibility and innovation in programme design and syllabi development, teaching learning process, assessment of student learning levels. A comprehensive knowledge ofstructure-function relationship at the level of gene, genome, cell, tissue, organ, and systems, through development would further add to the knowledge base and the learning outcome in terms of editing of genes and genomes for industrial applicationand research purposes.

Learning Outcomes based approach to Curriculum Planning:

The courses should be delivered in terms of concepts, mechanisms, biological designs & functions and evolutionary significance cutting across organisms at B.Sc. level. These courses should be studied by students of all branches of biology. Both chalk and board, and PowerPoint presentations can be used for teaching the course. The students should do the dissertation/ project work under practical of different courses, wherever possible.

The students are expected to learn the courses with excitements of biology along with the universal molecular mechanisms of biological designs and their functions. They should be able to appreciate shifting their orientation of learning from a descriptive explanation of biology to a unique style of learning through graphic designs and quantitative parameters to realize how contributions from research and innovation have made the subjects modern, interdisciplinary and applied and laid the foundations of Zoology, Animal Sciences, Life Sciences, Molecular Biology andBiotechnology. These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research. In addition, they may get interested to look for engagementsin industry and commercial activities employing Life Sciences, Molecular Biology and Biotechnology. They may also be interested in entrepreneurship and start somesmall business based on their interest and experience.

Graduate Attributes in Zoology:

- Disciplinary knowledge and skills: Competent of demonstrating (i) complete information and understanding of major concepts, theoretical principles and experimental findings in Zoology and its different subfields (ii) capacity to apply modern instrumentation for advanced genomic and proteomic technology.

- Skilled communicator: Capability to communicate complex technical knowledge relating to Zoology in an obvious and brief manner in writing and oral skills.

- Critical thinker and problem solver: Talent to have critical thinking and competent problem solving skills in the basic areas of Zoology

- Sense of inquiry: Capability for asking appropriate/proper questions relating to issues and problems in the field of Zoology, and planning, executing and reporting the results of an experiment or investigation.

- Team player/worker: Accomplished of working effectively in diverse teams in both classroom, laboratory and in industry and field-based situations.

- Skilled project manager: Able of identifying/mobilizing appropriate resources required for a project, and manage a project to completion, while observing responsible and ethical scientific conduct; and safety and chemical hygiene regulations and practices.

- Digitally literate: Skilled of using computers for Bioinformatics and computation and appropriate software for analysis of genomics and proteomics data, and employing modern bioinformatics search tools to locate, retrieve, and evaluate location and biological annotation genes of different species.

- Ethical awareness/reasoning: Capable of conducting their work with honesty and precision thus avoiding unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, and appreciating environmental and sustainability issues. Research ethics committee expects them to declare any type of conflict of interest that may affect the research. Any plan to withhold information from researchers should be properly explained with justification in the application for ethical approval.

- Lifelong learners: Capable of self-paced and self-directed learning aimed at individual growth and for improving knowledge/skill development and re-skilling

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 themain 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.

PAH Solapur University, Solapur

Faculty of Science-New Choice Based Credit System (CBCS) - (w.e.f.2024-25)

Structure for B. Sc-III

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.- III Semester – V**									
Ability Enhancement Course(AECC)		**English (Business English)**	Paper- III	4.0	--	--	100	80	20	4.0
Discipline Specific Elective (DSE) (Students can opt any one subjects among the three Subjects excluding interdisciplinary offered at B.Sc II.		**DSE-1A- Molecular Biology**	Paper- IX	3	--	--	100	80	20	4.0
		DSE- 2 A- Principles of Genetics	Paper -X	3	--	--	100	80	20	4.0
		DSE- 3 A-Endocrinology	Paper- XI	3	--	--	100	80	20	4.0
		DSE 4 A- Wildlife Conservation & Management	Paper- XII	3	--	--	100	80	20	4.0
		(Add-on /-self learning)- MOOC/SWAYAM/Skill based -certificate course –institute or university /internship/ apprenticeship		--	--	--	--	--	--	4.0
Grand Total				**16.0**	**--**	**--**	**500**	**400**	**110**	**24**
Class :	**B.Sc.- III Semester –VI**									
Ability Enhancement Course(AECC)		**English (Business English)**	Paper IV	4.0	--	--	100	80	20	4.0
DSE (Students can opt any one subjects among the three Subjects excluding interdisciplinary offered at B.Sc. II.		**DSE- 1B -Animal Physiology: Life Sustaining Systems**	Paper -XIII	3.0	--	--	100	80	20	4.0
		DSE- 2B- Evolutionary Biology	Paper- XIV	3.0	--	--	100	80	20	4.0
		DSE- 3B -Animal Behaviour And Chronobiology	Paper- XV	3.0	--	--	100	80	20	4.0
		DSE 4B- Applied Zoology	Paper- XVI	3.0	--	--	100	80	20	4.0
Total (Theory)				**16.0**	**--**	**--**	**500**	**400**	**100**	**20**

DSE - Practical (Annual Exam)	**DSE- 1 A&B**	Practical- IX & XIII	--	--	5	100	80	20	4.0
	DSE -2 A&B	Practical- X&XIV	--	--	5	100	80	20	4.0
	DSE- 3 A&B	Practical- XI&XV			5	100	80	20	4.0
	DSE- 4 A& B	Practical- XII & XVI			5	100	80	20	4.0
Total (Practicals)					**20**	**400**	**320**	**80**	**16**
Grand Total			**32.0**		**20**	**1400**	**1120**	**280**	**60**

Summary of the Structure of B.Sc. Programme as per CBCS pattern

Class	Semester	Marks- Theory	Credits- Theory	Marks- Practical	Credits- Practicals	Total – credits
B.Sc.-I	I	500	20	--	--	20
	II	550	20	400	16	36
B.Sc.-II	III	350	14	--	--	14
	IV	350	14	300	12	26
B.Sc.-III	V	500	22	--	--	22
	VI	500	20	400	16	36
Total		2750	110	1100	44	154

B.Sc.Programme :

Total Marks : Theory + Practical's = 2750 +1100 =3950
Credits : Theory + Practical's = 110 + 44 = 154
Numbers of Papers Theory: Ability Enhancement Course(AECC) 05
Theory: Discipline Specific Elective Paper (DSE) 08
Theory: DSC 12
Skill Enhancement Courses /Add on 01
Total : Theory Papers 31
: Practical Papers 11

Abbreviations :

L: Lectures
T: Tutorials
P: Practicals
UA : University Assessment
CA : College Assessment
DSC / CC: Core Course
AEC : Ability Enhancement Course
DSE : Discipline Specific Elective Paper
SEC : Skill Enhancement Course
GE : Generic Elective
CA: Continuous Assessment
ESE: End Semester Examination

PAH SOLAPUR UNIVERSITY, SOLAPUR
Faculty of Science
Choice Based Credit System (CBCS)(w.e.f. 2024-25)

• Title of the Course: B.Sc. Part-III (Honors)
• 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:**
To provide an intensive and in depth learning to the students in field of Zoology. Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing world. To develop awareness & knowledge of different organization requirement and subject knowledge through varied branches and research methodology in students. 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. 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. Scientific Research Organizations. Universities in India & aboard.

• Medium of Instruction: English
• Syllabus Structure:
• The University follows semester system.
• An academic year shall consist of two semesters.
• B.Sc. Part-IIl Zoology shall consist of two semesters: Semester V and Semester VI

In semester V: there will be Four DSC papers having paper IX to XII of 100 marks each. There will a **Compulsory paper on "Ability Enhancement Compulsory Course (AECC)" on** English and one self learning compulsory course of any one from - MOOC/SWAYAM COURSE/INTERNSHIP

In Semester VI: there will be two DSC papers having paper XIII to paper XVI of 100 marks each. There will a **Compulsory paper on "Ability Enhancement Compulsory Course (AECC)" on** English

The scheme of evaluation of performance of candidates shall be based on UniversityAssessment **(UA**) as well as **College Internal Assessment (CA)** as given below.

For B.Sc.Part-III Zoology Sem V & VI the ‒internal assessment‖ will be based on Internal tests, Home assignment, Tutorials, Open Book Examination, 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 400 marks shall also consist of **320 marks for University practical assessment** and **80 marks for college internal assessment (CA)**.

• **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 80 marks..

Semester – V: Theory: (100 marks): Comprising DSE-

a) University Examination (UA) (80 marks): No. of theory papers: 4 (paper IX to paper XII)

b) Internal Continuous Assessment (CA) (20 marks) No. of theory papers: 4 (paper IX to paper XII)
c) **Compulsory paper on "Ability Enhancement Compulsory Course (AECC)" on** English
d) One Add-on - self learning course **(compulsory)** MOOC/SWAYAM/Sill based -certificate course –institute or university /internship/ apprenticeship

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

Semester – VI: Theory: (100 marks): Comprising DSE-

a) University Examination (UA) (80 marks): No. of theory papers: 4 (paper XIII to paper XVI)

b) Internal Continuous Assessment (CA) (20 marks) No. of theory papers: 4 (paper XIII to paper XVI)

Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.
Practical Examination: (400 marks)
University Examination (320 marks): Number . of practicals': 04

Practical-I: Based on **Papers- IX & XIII** (80 UA + 20 CA) Practical-II: Based on **Papers- X & XIV** :(80 UA + 20 CA) Practical-III: Based on papers - **XI & XV** :(80 UA + 20 CA)Practical-IV: Based on papers - **XII& XVI** :(80 UA + 20 CA)

Internal Continuous Assessment: Total 80
(a) Internal practical test and
(b) Viva/group discussion/model or chart/attitude/attendance/overall behavior
(c) University practical examination of 320 marks (Practical I to IV for Four separatedays) will be conducted at the end of semester VI
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

PAH SOLAPUR UNIVERSITY, SOLAPUR Faculty of Science and Technology New CBCS Structure for B.Sc. – III Zoology Theory -								
Semester V								
Paper No.	**Title of Paper**	**Hrs/Week**			**Paper Marks**	**U A**	**C A**	**Credits**
		L	T	P				
Ability Enhancement Course(AECC)	**English (Business English)**	4	-	-	100	80	20	4
DSE-IX	**DSE-1A -Molecular Biology**	3	-	-	100	80	20	4
DSE-X	**DSE- 2 A -Principles of Genetics**	3	-	-	100	80	20	4
DSE-XI	**DSE- 3A - Endocrinology**	3	-	-	100	80	20	4
DSE-XII	**DSE 4 A- Wildlife Conservation & Management**	3	-	-	100	80	20	4
SEC-	**(Add-on /-self learning)- MOOC/SWAYAM/Skill based - certificate course –institute or university /internship/ apprenticeship**	-	-	-	--	--	--	4.0
Total		16	-	-	500	400	100	24

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 stipulated marks of external examination and his/her performance shall be scaled to 100 marks.

• ATKT:

passed in all papers except 6 (six) papers combined together of semester III and IV of B.Sc. Part-II Zoology examination and clearly passed in B.Sc. Part-I-Zoology shall bepermitted to enter upon the course of Semester V of B.Sc. III Zoology.

Semester –VI								
Paper No.	**Title of Paper**	**Hrs/Week**			**Paper Marks**	**UA**	**CA**	**Credits**
		L	T	P				
Ability Enhancement Course(AECC)	**English (Business English)**	4	-	-	100	80	20	4
DSE- -XIII	**DSE- 1B -Animal Physiology: Life Sustaining Systems**	3	-	-	100	80	20	4
DSE-XIV	**DSE- 2B- Evolutionary Biology**	3	-	-	100	80	20	4
DSE-XV	**DSE- 3 B- Animal Behaviour And Chronobiology**	3	-	-	100	80	20	4
DSE-A XVI	**DSE 4B- Applied Zoology**	3	-	-	100	80	20	4
Total		16			500	400	100	20

Practicals- B .Sc III Zoology (CBCS)									
Practical No.	**Paper No. based on**	**Title of Paper**	**Hrs/Week**			**Paper Marks**	**UA**	**CA**	**Credits**
			L	T	P				
I	Papers-IX & XIII	**DSE-1A- Molecular Biology AND DSE- 1B- Animal Physiology: Life Sustaining Systems**		-	5	100	80	20	4
II	Papers-X&XIV	**DSE- 2 A -Principles of Genetics** AND **DSE- 2B -Evolutionary Biology**		-	5	100	80	20	4
III	Papers-XI&XV	**DSE- 3A- Endocrinology AND DSE- 3 B - Animal Behaviour and Chronobiology**		-	5	100	80	20	4
IV	Papers-XII & XVI	**DSE 4 A- Wildlife Conservation & Management AND DSE 4B- Applied Zoology**		-	5	100	80	20	4
	Total				**20**	**400**	**320**	**80**	**16**

Abbreviations:

L: Lectures
T: Tutorials
P: Practicals
UA: University Assessment by End Semester Examination
CA: College Assessment by Internal Continuous Examination
UA: University Assessment: - University Theory paper shall be of 70 marks
CA: College Assessment: - The internal examination for theory and practical course

PAH SOLAPUR UNIVERSITY, SOLAPUR (CBCS) Theory Syllabus

B.Sc. III-Zoology (Semester-V)

w. e. f. June 2024

Paper- -IX- DSE-1A Molecular Biology
[Credits -4, Total Lectures-60]

Unit 1: Nucleic Acids **4**

Salient features of DNA and RNA
Watson and Crick model of DNA

Unit 2: DNA Replication **12**

DNA Replication in prokaryotes and eukaryotes, Semi-conservative mechanism of DNA replication, Replication of circular.

Unit 3: Transcription **10**

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, transcription factors.

Unit 4: Translation **12**

Properties of genetic code: Degeneracy and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, amino-acyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Difference between prokaryotic and eukaryotic translation

Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA **6**

Mechanism of Capping, Splicing (concept of exon and intron) and Polyadenylation of eukaryotic m-RNA and its significance.

Unit 6: Gene Regulation **10**

Transcription regulation in prokaryotes: Principles of transcriptional regulation with example of lac-operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements.

Unit 7: DNA Repair Mechanisms **3**

Pyrimidine dimerization, mismatch repair & SOS mechanism

Unit 8: Recombinant DNA Technology **3**

Basic mechanism of R-DNA Technology and its applications in medicine, agriculture & industry; RNA interference, miRNA, siRNAs.

- **About the course:**

The course provides an insight into the life processes at the subcellular and molecular levels. Other important aspects include DNA and molecular genetics including gene cloning, sequencing and gene mapping in addition to the powerful techniques that revolutionized the pharmaceutical, health and agricultural industries.

- **Learning outcomes**:

After successfully completing this course, the students will be able to:

- Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario.
- Get well versed in recombinant DNA technology which holds application in biomedical & genomic science, agriculture, environment management, etc. Therefore, a fundamental understanding of Molecular Biology will help in career building in all these fields.
- Apply their knowledge in problem solving and future course of their career development in higher education and research.
- Get new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry.

SUGGESTED READINGS:

1) Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: Molecular Biology of the Cell, IV Edition.
3) Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V-Edition, ASM Press and Sinauer Associates.
4) De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
5) Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI-Edition. John Wiley and Sons. Inc.
6) Lewin B. (2008). Gene XI, Jones and Bartlett
7) McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV-Edition. GS, Taylor and Francis Group, New York and London.

Paper- -X- DSE-2 A: Principles of Genetics
[Credits -4, Total Lectures-60]

Unit 1: Mendelian Genetics and its Extension **8**

Principles of inheritance-Laws of Mendelian Inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles; Gene Interactions: Supplementary, Complementary & Inhibitory interactions; Examples of Sex-linked, sex-influenced and sex-limited characters inheritance.

Unit 2: Linkage, Crossing Over and Chromosomal Mapping **12**

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity; Somatic cell hybridization.

Unit 3: Mutations **10**

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method.

Unit 4: Sex Determination **4**

Chromosomal mechanisms of sex determination in Drosophila and Human; Human Genetic Disorders: Mechanism, symptoms, treatment: Down‘s Syndrome, Klinefeler‘s Syndrome and Turner‘s Syndrome

Unit 5: Extra-chromosomal Inheritance **6**

Extra-chromosomal inheritance with examples

Unit 6: Polygenic Inheritance **3**

Polygenic inheritance with suitable examples; simple numerical.

Unit 7: Recombination in Bacteria and Viruses **9**

Conjugation, Transformation, Transduction with examples; Complementation test in Bacteriophage.

Unit 8: Transposable Genetic Elements **8**

Transposons in bacteria

About the course

The course is designed to revise basic concepts of Genetics and then move on to advanced concepts. Some key aspects include the mechanism of inheritance, gene structure and function, sex chromosomal and autosomal anomalies, aspects of human genetics, etc. will be covered. A strong emphasis will be laid on the modern tools and techniques used in genetics.

Learning outcomes:

After successfully completing this course, the students will be able to:

- Understand how DNA encodes genetic information and the function of mRNA and tRNA
- Apply the principles of Mendelian inheritance.

- Understand the cause and effect of alterations in chromosome number and structure.
- Relate the conventional and molecular methods for gene manipulation in other biological systems.
- Discuss and analyse the epigenetic modifications and imprinting and its role in diseases.
- Get new avenues of joining research in related areas such as genetic engineering of cells, cloning, genetic disorders, human fertility programme, genotoxicity, etc

SUGGESTED READINGS:

1) Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India
2) Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V-Edition. John Wiley and Sons Inc
3) Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings
4) Russell, P. J. (2009). *Genetics- A Molecular Approach.*III Edition. Benjamin Cummings
5) Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
6) Fletcher H. and Hickey I. (2015). *Genetics.* IV Edition. GS, Taylor and Francis Group, New York and London

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Paper- -XI- DSE-3 A: Endocrinology
[Credits -4, Total Lectures-60]

Unit 1: **Introduction to Endocrinology** **12**

History of endocrinology, Brief introduction of endocrine glands, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormones

Unit 2: Epiphysis **06**

Location & structure of pineal gland, Secretions and their functions in biological rhythms and reproduction.

Unit-3: Hypothalamo-hypophysial Axis
07

Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands, Feedback mechanism.

Unit 4: Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophysial
06
portal system, Control and Disorders of pituitary gland.

Unit 5: Regulation of Hormone Action **11**

Hormone action at Cellular level: Hormone receptors, transduction and regulation Hormone action at Molecular level: Molecular mediators, Genetic control of hormone action

Unit 6: Structure, Hormones, Functions and Regulation and Disorders of Testis **08**

Unit 7: Structure, Hormones, Functions and Regulation and Disorders of Ovary
06

Unit 8: Structure, Hormones, Functions and Regulation and Disorders of Placenta
04

About the course

The course envisages information on endocrine system with emphasis on the structure of hypothalamus and anterior pituitary. The associated hormones and the related disorders will be explained.

Learning outcomes:

- Understand neurohormones and neurosecretions.
- Learn about hypothalamo and hypapophysial axis.
- Understand about different endocrine glands and their disorders.
- Understand the mechanism of hormone action.

SUGGESTED READINGS

1) General Endocrinology C. Donnell Turner Pub- Saunders Toppan
2) Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead.
3) Oxford: BIOS Scientific Publishers; 2001.
4) Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice-Hall, Pearson Education Inc., New Jersey.

5) David O. Norris & J. A. Carr. Vertebrate Endocrinology, 6th Ed., Academic Press

Paper- -XII- DSE-4 A: Wildlife Conservation & Management [Credits -4, Total Lectures-60]

Unit 1: Introduction to Wild Life **8**

Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Unit 2: Evaluation and Management of Wild life **8**

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

Unit 3: Management of Habitats **8**

Setting back succession; Grazing logging; Mechanical treatment; Advancing the succession process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats.

Unit 4: Population Estimation **8**

Methods of population estimation: Sex ratio computation; Fecal analysis of ungulates and carnivores: Hair identification, Pug marks and census method.

Application of biostatistics in Biodiversity estimation: Analysis of Shannon and Simpson's Diversity Indices.

Unit 5: Management Planning of Wild life in Protected Areas **8**

Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbence.

Unit 6: Management of Excess Population **7**

Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Unit 7: Protected areas **8**

National parks & sanctuaries in India, Community reserve; important features of protected areas in India; Tiger conservation- Tiger reserves in India & its management challenges; Great Indian Bustard (GIB) Reserve & its management.

Unit 8: Wildlife Protection Acts: National: Wildlife Protection Act-1972 and conservation International: CITES, 1975 Definition, Concept of different categories of IUCN'S Red data list

About the course

The course envisages information on wildlife management

Learning outcomes

- Students will understand the factors affecting the need to find sustainable practices

- Students will understand the general principles of ecology as how they related to terrestrial and/or aquatic plant and animal conservation and management.
- Students will be able to identify species, characteristics, habitat requirements and life cycles of birds, fish and/or wildlife species.
- Students will be able to evaluate current events and public information related to wildlife conservation and management as being scientifically-based or opinion

SUGGESTED READINGS:

1) Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
2) Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Co-existence? Cambridge University.
3) Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society, Allen Press.
4) Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
5) Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

SEMESTER –VI

PAH SOLAPUR UNIVERSITY, SOLAPUR (CBCS)
Theory Syllabus

B.Sc. III-Zoology (Semester-VI)

w. e. f. June 2024

Paper- -XIII- DSE-1B Animal Physiology: Life Sustaining Systems

[Credits -4, Total Lectures-60]

Unit 1: Physiology of Digestion **10**

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Digestion and absorption in stomach and intestine; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2: Physiology of Respiration **10**

General mechanism of respiration in mammals, Pulmonary ventilation; Respiratory volume and capacities; Transport of oxygen and carbon dioxide in blood; Dissociation curves and the factors influencing it; Control of respiration: Chemical & Nervous.

Unit 3: Respiratory pigments: Types structure and function
04

Hemoglobin, hemocyanin, erythrocruorin-chlorocruorin, hemerythrin

Unit 4: Renal Physiology **8**

Structure of Kidney and its functional unit (nephron); Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance; Dialysis.

Unit 5: Blood and Blood groups : **12**

Haematopoiesis – Brief account, Components of blood – RBC, WBC & Platelets and their functions; Blood clotting system, Complement system & Fibrinolytic system.

Types of Blood groups -ABO and MN type, blood group antigens, Rh factor & Erythroblastosis Foetalis.

Unit 6: Physiology of Heart **08**

Structure of mammalian heart; Origin, structure & working of heart beat (SA Node, AV Node & Purkinje‘s Fibre), Coronary circulation; Pacemaker.

Unit 7: Cardiac cycle: **04**

Cardiac output and its regulation, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

Unit 8: Physiology of Stress
04

1. Introduction to stress physiology

2. Managing stress by exercise, yoga and meditation

About the course:

The course deals with various physiological functions in mammals. It also gives an account of the metabolic/ biochemical pathways and the probable impact of environment on them.

Learning outcomes

After successfully completing this course, the students will be able to:

- Understand the physiology at cellular and system levels.
- Understand the mechanism and regulation of breathing, oxygen consumption and determination of respiratory quotient. .
- Understand the process of digestion and excretion.
- Understand the renal physiology
- Understand the process in haematology
- Learn the determination of hemoglobin content, blood groups and blood pressure.
- Understand the process of Physiology of Heart

SUGGESTED READINGS

1) Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
2) Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI-Edition John Wiley & sons,
3) Victor P. Eroschenko. (2008). diFiore‘s Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
4) Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

Paper- -XIV- DSE-2B: Evolutionary Biology

[Credits -4, Total Lectures-60]

Unit 1: Life Beginnings **7**

Chemogeny, RNA world, organic evolution, Evolution of eukaryotes.

Unit 2: Historical Review of Evolutionary Concepts **4**

Lamarckism, Darwinism, Neo-Darwinism

Unit 3: Evidences of Evolution: **10**

Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular evolution:- universality of genetic code and protein synthesizing machinery, example of globin gene family.

Unit 4: Sources of Variation **8**

Sources of variations: Heritable variations and their role in evolution

Unit 5: Population Genetics **10**

Hardy-Weinberg Law: statement and derivation of equation, application of law to human Population; Evolutionary forces upsetting H-W equilibrium: Natural selection, genetic drift, mutation and migration.

Unit 6: Product of Evolution: **10**

Micro evolutionary changes - inter-population variations, clines, races, species concept, isolating mechanisms, modes of speciation—allopatric, sympatric & parapatric; Adaptive radiation/ macroevolution as exemplified by Galapagos finches.

Unit 7: Extinctions **3**

Back ground and mass extinctions: causes and effects; example of K-T extinction.

Unit 8: Origin and Evolution of Man **8**

Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, molecular analysis of human origin; Socio-cultural evolution of man.

About the course

The course provides information about the patterns and processes of evolution above the species level. Besides elaborating the process of speciation, it also categorically differentiates between the three methods of phylogenetic analysis *viz.*, evolutionary systematics, phonetics and cladistics.

Learning outcomes

At the end of the course the students will be able to

- Understand the historical development of systematics past to the present.
- Understand the similarities and differences of different types of data.
- Understand the uses and limitations of phylogenetic trees.
- Appreciate the complexities and difficulties of various species concepts.
- Gain a basic grasp on the rules and philosophy of nomenclature.

SUGGESTED READINGS:

1) Ridley,M (2004) Evolution III Edition Blackwell publishing
2) Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
3) Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin & Cummings.
4) Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
5) Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley-Blackwell

Paper- -XV- DSE-3B : ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

[Credits -4, Total Lectures-60]

Unit 1: Introduction to Animal Behavior **7**

Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behavior.

Unit 2: Patterns of Behavior **8**

Stereotyped Behaviours (Orientation, Reflexes); Instinct vs. Learnt Behavior; Associative learning, classical and operant conditioning, Habituation, Imprinting.

Unit 3: Social Behavior **5**

Concept of Society; Communication and the senses; Altruism; Insects‘ society with Honey bee as example; Foraging & dance language in honey bee and its advantages.

Unit 4: Sexual Behavior **5**

Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice).

Unit 5: Introduction to Chronobiology **9**

Historical developments in chronobiology; Biological oscillation: the concept of average, amplitude, phase and period. Adaptive significance of biological clocks.

Unit 6: Biological Rhythm **8**

Types and characteristics of biological rhythms: Short- and Long- term rhythms;
Circadian rhythms; Tidal rhythms and Lunar rhythms;
Photoperiod and regulation of seasonal reproduction in vertebrates; Role of melatonin in biological rhythms.

Unit 7: Biological Clocks **4**

Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.

Unit 8: Chronobiology and drug discovery **4**

Brief idea of chronopharmacology and its role in various diseases

About course:

- Many animal species have a sort of internal clock, called a biological clock, which predicts cyclical environmental change and prepares the animal to deal with it. Biological rhythms are self –sustaining natural cycles of animal life history which maintain themselves regardless of the environmental factors

Learning outcomes:

- Understand the. Biological Clocks and its importance
- Understand how Biological Rhythm influence animal behavior
- Understand Social and Sexual Behaviour of animals
- Understand Behaviour Patterns of animals

SUGGESTED READINGS:

1) David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
2) Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
3) John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
4) Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
5) Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc.Publishers, Sunderland, MA, USA
6) Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.)R.D.Lewis. (3rdEd) 2002 Barens and Noble Inc. New York, USA
7) Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

Paper- -XVI- DSE-4B : Applied Zoology

[Credits -4, Total Lectures-60]

UNIT 1: Introduction to Aquaculture: **7**

Fish Culture, Breeding Pond, Fish Seed, Hatching pond. Transport of fish fry to rearing ponds. Harvesting, preservation of fish. By products of fishing industry and common fish diseases Bacterial- Aeromonas hydrophila, Viral-Lymphocystis, Fungal-Gill/Mouth Rot Prawn culture: Culture of fresh water prawn

UNIT 2: Fisheries: **8**

Inland Fisheries; Marine Fisheries
Fishing crafts-Raft, Trawler, Shampan, Canoe, Caterman and Gears-Gill net,Trawls net, Bag net, Rampani net, Cast net,Lines and Hooks Depletion of fisheries resources; Application of remote sensing and GIS infisheries; Fisheries law and regulations.
Application of biostatistics in Fishery: morphometric analysis of length, weight to determine mean, mode, variance and standard deviation

UNIT 3: Apiculture: **8**

a) Apiculture: Species of honey bees in India. Life history of *Apis.* Methods of Bee keeping. Bee products and their uses. Natural enemies and their control.; Medicinal value of honey; Importance of bee colonies in crop pollination.

Unit-4: Lac culture **7**

Lac insect and its life cycle, Cultivation of lac insect, host plants, processing and uses of lac.

Unit 5: Sericulture 8

Types of silk; Silkworms and their host plants; Mulberry silkworm culture; Life history of silkworm; Natural enemies and their control

Unit 6: Dairy Management **7**

Introduction to common dairy animals. Techniques of dairy management. Milk and milk products. Cattle Diseases.

Unit 7: Poultry Management **10**

Types of breeds. Rearing method. Diseases and control measures. Housing and Equipment, Deep litter System, Laying cages, Methods of brooding and Rearing,. Feed formulations for chicks, Diseases of fowl. Nutritive value of egg and meat. Incubation and hatching of eggs.

UNIT 8: Recent advances applied zoology **5**

Zebrafish as a model organism in research, transgenic animals (Salmon, chicken, goat, pigs) & its significance.

About course:

Applied Zoology is the enterprise of raising or harvesting of fishes, prawns, honey bees, lac insects, silkworms, poultry birds and dairy industry. It will allow students to employ the knowledge of zoology in entrepreneurship.

Learning outcome :

- Students will understands the fisheries
- Students will learn the sericulture and Lac culture techniques
- Students will understand the Apiculture techniques
- Students will learn how to initiate Aquaculture practices.
- Students can incorporate social information about poultry and dairy

SUGGESTED READINGS

1) Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
2) D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R.J. Mogdans and B.G. Kapoor.The Senses of
3) Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
4) C.B.L. Srivastava, Fish Biology, Narendra Publishing House
5) J.R. Norman, A history of Fishes, Hill and Wang Publishers
6) S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House

PAH SOLAPUR UNIVERSITY, SOLAPUR (CBCS)
B.Sc. III-Zoology
w. e. f. June 2024 --Practicals Syllabus
(Where ever possible use virtual /CD/ Videos /models/simulations should be used during practical demonstration)

Practical -I

Paper No. based on : Papers- IX & XIII-

DSE-1A Molecular Biology
AND
DSE- 1B Animal Physiology: Life Sustaining Systems
(Credits-4)

DSE-1A Molecular Biology:-Practicals

1) Cell Division: Study of meiosis in onion bud
2) Molecular Biology: i) Isolation of DNA from suitable material. ii) construct paper model DNA by using nucleotides
3) Chromatography: Demonstration/ Separation of amino acids using paper chromatography by TLC
4) Quantitative estimation of DNA using colorimeter (Diphenylamine reagent)
5) Quantitative estimation of RNA using Orcinol reaction
6) Demonstration of DNA and RNA using methyl green pyronine
7) Demonstrate of retrieval of gene sequence using bioinformatics tools - NCBI, Entrez, BLAST- -hemoglobin / insulin-- gene /protein in FASTA format
8) Electrophoresis: Demonstration of electrophoretic separate of protein /DNA by/Agarose/PAGE method
9) Codon Analysis: To find out codon sequences for known polypeptide chain of ten amino acids or to find out amino acid sequence from given codons (chart will be provided)
10) Karyotyping: Study of human Karyotype(s): Normal male and female (Classification of chromosomes according to size and position of centromere); Down syndrome, Klinefelter's syndrome, Turners syndrome using pictures of karyotypes & Idiograms

DSE- 1B Animal Physiology: Life Sustaining Systems

1. Estimation of salivary amylase activity
2.Measurement of blood pressure and heart beat under normal and any two physical stress condition.
3. Determination of Body Mass Index (BMI)
4.Enumeration of Red Blood Cells (RBCs) and White Blood Cells (WBCs) using haemocytometer.
5. Differential count of WBCs using Leishman's/Geimsa stain
6. Estimation of haemoglobin and carrying capacity of blood.
7. Preparation of haemin crystals
8. To determine blood clotting time using capillary method
9.Determination of abnormal and normal constituents of urine
10. Estimation of normal oxygen (O2) consumption using any aquatic animal and /or effect of temperature on the rate of oxygen consumption
11. Histological studies of mammalian organs: oesophagus, stomach, duodenum, ileum, rectum, liver, trachea, lung, kidney
12. Estimation of uric acid from sample
13 .**Field Visits:** Local water bodies for collection of planktons / Visit to medical college/ blood bank / IVF center, / Pranayam and yoga meditation center for study and submission of report
(*Subject to UGC guidelines)

Practical –II

Paper No. based on : Papers- X &XIV

DSE- 2A Principles of Genetics

AND

DSE- 2B Evolutionary Biology

(Credits-4)

Practicals:-

DSE- 2A Principles of Genetics

1. Examples in Genetics based on Monohybrid ratio (05 examples)
2. Examples in Genetics based on Dihybrid ratio (05 examples)
3. Examples based on multiple alleles: Blood groups, Coat color in rabbit (05 examples)
4. Examples based on gene interactions (Complementary, Supplementary & Inhibitory interactions) (05 examples).
5. Examples based on human genetic traits: Rolling tongue, free & attached ear lobes, hitchhiker's thumb, PTC taste, Widows Peak Hairline (01 example from each)
6. Laboratory culture of *Drosophila* to study its life cycle
7. Study of normal genetic traits of *Drosophila* using cultured material
8. Pedigree analysis of some human inherited traits
9. Fieldwork to collect data on genetic diseases from local hospitals
10. To perform statistical analysis (age, sex, family history etc.) of data on genetical diseases from local hospitals (Bar diagram, Pie Chart)

DSE- 2B Evolutionary Biology

1. Study of types of fossils using samples available in Zoology and Geology Lab./or models (for eg. Limulus, Peripatus, Dipnoi, Sphenodon, *Archaeopteryx*, examples based on: Molluscan, Echioderms, Brachiopods and as available in laboratory)
2. Study of Zoogeographical Regions of world to understand the concept of speciation with examples
3. Study of biogeographic zones of India to study evolutionary variation and adaptation in species with examples
4. Study of macroevolution using Darwin's Finches using charts/models

5. Study of homologous organs from suitable specimens/models in the museum
6. Study of analogous organs from suitable specimens/ models in the museum
7. Study of adaptive radiation in mammals from museum specimens/models
8. Examples based on Hardy Weinberg Law (08 examples)
9. Study of phylogeny of horse using model/charts (reconstruction using limbs and teeths of horse ancestors)
10. Construction of phylogenetic tree using bioinformatic tools/softwares (Searching sequences of any five genes or proteins using biological databased (NCBI, GenBank or DDBJ, construct phylogenetic tree using Clustal X, Phylip, NJ & submit the report).
11. Visit to natural history museum and submission of report
12. **Project work-** Research project should be prepared in consultation with faculty either individually or in group as required. The research guide will support students in selecting and executing the entire topic and preparing the report for final submission during examination after approval of the guide in the following format-

(a) Format of Report: Title, Introduction, Review of literature, Objectives, Material and Methodology, Result and discussion, Conclusion & References

(b) Submission & presentation of research work: At the time of practical examination submit the final project report (hard copy) and present your research findings using ‗PowerPoint'.

Practical –III

Paper No. based on : Papers- XI & XV

DSE- 3A Endocrinology
AND
DSE- 3 B ANIMAL BEHAVIOUR AND CHRONOBIOLOGY
(Credits -4)

Practicals- DSE- 3A Endocrinology–

1. Identification explanation of endocrine glands in rat using model / virtual method
2. Study of the permanent slides of endocrine glands: Pineal, pituitary, testis, ovary and placenta
3. Observation of insect life cycle and its hormonal control- metamorphosis
4. Observation of amphibian metamorphosis and its hormonal control.
5. Study of circadian functions in human and its correlation with hormones (daily eating & pre & post-meal insulin level, sleep & role of melatonin and day length & body temperature w. r. t. hypothalamus).
6. To study cyclical variation in body temperature during menstrual cycle using model/chart
7. To study flight and fight behavior to understand reflex action and role of adrenalin hormone
8. To collect data on hormonal disorders from local hospitals and its interpretation
9. Hormonal regulation of reproductive hormones in human with age using chart
10. Study of contraceptive pills with reference to hormone and its mechanism
11. Visit to IVF centre/hospital and submit a report

Practicals- DSE- 3 B ANIMAL BEHAVIOUR AND CHRONOBIOLOGY–

1. Observation of nests and nesting behavior of the birds.
2. Observation of termatoria of ants and termites.
3. Study and observation of casts in ants and honey bees.
4. Observation of geotaxis behaviour in earthworm.
5. Observation of phototaxis behaviour in insect larvae.
6. Observation of intra-specific behavior: Dancing behavior in honey bees; flocking behavior in birds and Courtship behavior in Great Indian Bustard and Peacock (virtual)
7. Observation of inter-specific behavior between: Ant-*Acacia*, Buffalo-cattle egret, Fig-wasp pollination, Root nodules-bacteria, Tick-dog using models/charts/museum specimens

8. Recording and interpretation of calls, songs, vocalizations of insects (e.g. cricket), amphibians, birds and mammals and their importance in signaling behavior (based on actual records or internet collection)
9. Observation of foraging behavior in ants to study chemo-signaling
10. Observation of foraging behavior in *Calotes*, *Hemidactylus*, *Chameleon* and *Naja*
11. Observation of nest parasitism in Asian koel
12. Study tour /:
(a) Agriculture research center, Yoga & Meditation center, Biotechnology lab, etc.
(b)summer or winter training programmes/workshops/field survey with NGOs & GOs: students can work in various institutes/laboratories/NGOs etc. for period up to 07 days and prepare a report for submission during exam
(c) Visit to Forest/ Biodiversity Park/Zoological Park
to study behavioural activities of animals and prepare a short report.

Practical –IV

Paper No. based on : Papers- XII & XVI
DSE 4 A- Wildlife Conservation & Management
AND
DSE 4B- Applied Zoology

(Credits-4)

Practical-DSE 4 A- Wildlife Conservation & Management

1. Temporary preparation to study of faunal diversity of zooplanktons/insects/mollusca from surrounding area
2. Study of faunal diversity (amphibians, reptiles, birds and mammals) from campus & surrounding area
3. Demonstration of basic tools for field studies: Binocular, Global Positioning System, Cameras, Plankton & butterfly collecting net, insect collecting bottles, Mounting chamber for insects & preservation of museum specimens
4. Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
5. Casting of pug marks of common animals using plaster of Paris in and around campus
6. To perform line transect and quadrat method to study diversity in and around campus
7. To calculate species richness, abundance and Shannon diversity indices from collected data
8. Study of endangered species from India, their bio-geographic distribution and conservation status: Great Indian Bustard, Jerdon‘s Courser, Lesser Florican, Asian Elephant, Nilgiri Tahr, lion-tailed macaque, Nilgiri Langur, Lion, Sarus crane, Ganges River Dolphin, Hoolock Gibbon, Wild Ass, Olive Ridley Sea Turtle, Indian Pangolin, Leopard Cat.
9. Study of IUCN Categorization of Red List of animals (Data deficient, Least concern, Near Threatened, Vulnerable, Endangered, Critically endangered, Extinct in wild and Extinct)
10. Visit to local/state/national wildlife sanctuary or protected area or zoo and submission of report

Practical - DSE 4B- Applied Zoology

1. Morphometric and meristic characters of fishes (Length, width, weight, fins, scale type etc.)
2. Identification of major carps (*Labeo, Catla, Mrigal, Cyprinus*)
3. Preparation and study of temporary mount of cycloid and placoid scale from preserved specimens
4. Preparation and study of models of crafts, gears and their importance in Fisheries
5. Analysis of water quality parameters for Aquaculture: estimation of pH, Total Dissolved Solids (TDS);

dissolved O2 and free CO2 and hardness of given sample.
6. Study of honey bee morphology and identification of castes in honey bees (museum specimens/charts/specimens)
7. Observation of life cycle of mulberry silkworm, *Bombyx mori* (model/chart/specimens) and life cycle of tasar silkworm, *Antheraea mylitta*.
8. Test for good quality eggs (Floating test, cracking test) and for fertilized and unfertilized eggs (Light test, Cracking test).
9. Common dairy and poultry breeds in Solapur district
10. Biostatics: examples based on fish morphometry (any 05)
10. Demonstration of induced breeding in Fishes (video/model)
12. **Tour/Review of research:**

a) Excursion/Study Tour:- Visit to any National Parks/ Zoo parks / visit to any fish farm/ pisciculture unit/or Lab./marine water / freshwater habitat / Wildlife Sanctuaries / National or State Research Institutes / University departments / or other appropriate Institutes/poultry/dairy/sericulture units.
OR
b) Review of research work / student research publication: Review of 10 research papers related to zoology or life science and to prepare a review articles of minimum 5-10 pages
OR
c) Publication of one research paper in a peer reviewed journal in collaboration with teacher (accepted/published or personated research paper in seminar/conferences/symposia and submission of copy of presented paper with certificate

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Note:
1. Kindly note that during field visits students shall observe only animals and make record of the observations without disturbing natural habitat not kill the animals. Students should be told about the importance of biodiversity and conservation;
2. Students are encouraged to prepare and submit a concise report of the excursion;
3. Report on multiple excursion tours may be clubbed for preparing and submitting report at the time of final examination will be allowed;
4. Reduce or avoid the use of plastic files during submission of reports / projects as an ecofriendly method

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Skeleton paper for practical examination
(University Examination for 80 Marks)
Practical – I-

Practical – I-: Papers- IX & XIII-
DSE-1A Molecular Biology
AND
DSE- 1B Animal Physiology: Life Sustaining Systems

Question	Marks
Que:1- Preparation of meiotic stages from onion buds/ bioinformatics	10
Que:2- Isolation of DNA from given material /DNA estimation/RNA estimation	10
Que:3- Example(s) based on codon analysis/Chromatography/	10
Que:4- Estimation/enumeration of- haemoglobin/RBC/WBCs/salivary amylase /uric acid from sample/BMI	10
Que:5- Preparation of haemin crystals from given sample/Differential count of WBCs/Estimation of O2 consumption from aquatic animals/ Determination of blood	10

clotting time/ abnormal and normal constituents of urine	
Que:6- Spottings based on: a) Identify and describe: analysis karyotype b) Identify and describe: analysis of nucleotides separated using electrophoresis c) Identify and describe: methyl green pyronin-tissue /stained image d) Identify, sketch and describe: T.S. of esophagus, stomach, duodenum, ileum e) Identify, sketch and describe: T.S. of rectum, liver, trachea, lung, kidney	10
Que:7- Submission of Field Visit Report (any one of): Visit to local water bodies for collection of planktons / Visit to medical college/ blood bank / IVF center/yoga center	10
Que:8- Journal & Viva	10

Practical –II
Papers- X&XIV
DSE- 2 A Principles of Genetics
AND
DSE- 2B Evolutionary Biology

Questions	Marks
Que:1-Example based on monohybrid/dihybrid ratios/supplementary /complementary interactions/Multiple alleles (any one)	10
Que:2-Perform statistical analysis of given data on genetic disease(s) using MS-Excel©	10
Que:3- Construction of pedigree analysis of given data/example	05
Que:4-Example based on Hardy-Weinberg Law (any one)	10
Que:5-Construction of phylogenetic tree using bioinformatics tool	05
Que:6- Spottings based on: a) Identify and describe: Human genetic traits (rolling tongue, free & attached ear lobes, hitch-hikers thumb, wideow's peak, PTC taste) b) Identify and describe: Genetic traits of *Drosophila* (any one) c) Identify and describe: types of fossils (*Limulus, Peripatus, Archaeopteryx, Sphenodon* etc.) d) Identify, sketch and describe: Zoogeographic zones/biogeographic zones/macroevolution using charts/models/photographs e) Identify, sketch and describe: Analogous/homologous organs/adaptive radiation using charts/models/photographs/museum specimens	10
Que:7-Submission of Research Project Report & PPT presentation	20
Que:8-Journal & Viva	10

Practical –III **Papers- XI & XV** **DSE- 3A Endocrinology** **AND** **DSE- 3 B ANIMAL BEHAVIOUR AND CHRONOBIOLOGY**	
Questions	**Marks**
Que:1-Identify, sketch and discuss location, structure and function of endocrine glands of rat from model/chart (any two)	10
Que:2-Identify, sketch and discuss: insect life cycle & its hormonal control/amphibian metamorphosis & its hormonal control	10
Que:3-Interpret the given behavioral interaction: ant-Acacia; buffalo-cattle egret; fig-wasp; root nodules-bacteria; tick-dog based on model/chart/museum specimens	10
Que:4-Identify and interpret behavioral significance of call/song/vocalization (any 01 from journal)	10
Que:5-Discuss the behavior & its significance: Nest/termatoria/geotaxis/phototaxis/foraging (model/chart/museum specimens)	10
Que:6- Spottings based on: a) Identify and describe: Temperature variation during menstrual cycle/Circadian cycle & its hormonal correlation (any 01 from journal) b) Identify and describe: Flight & Fight response/contraceptive pill/ c) Identify and describe: hormonal regulation of reproduction d) Identify and describe behavior: Dancing/flock/courtship e) Identify and describe: Casts in honey bee	10
Que:7-12. Study tour / Internship: (a) Agriculture research center, , Biotechnology lab, etc. (b) summer or winter training programmes/workshops/field survey with NGOs & GOs: students can work in various institutes/laboratories/NGOs etc. for period up to 07 days and prepare a report for submission during exam (c) Visit to Forest/ Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.	10
Que:8-Journal & Viva	10

Practical –IV **Papers- XII & XVI** **DSE 4 A- Wildlife Conservation & Management** **AND** **DSE 4B- Applied Zoology**	
Question	**Marks**
Que:1-Calculate Shannon Diversity Indices from given data	**10**
Que:2-Perform line transect/quadrat method to study diversity	**10**
Que:3-Perform temporary mount & identification of zooplanktons/insects/mollusca from given sample	**10**
Que:4-Perform estimation of O_2/CO_2 /Hardness/TDS from given sample/biostatistics example	**10**
Que:5-Perform temporary mount of cycloid/placoid scales from preserved specimens	**10**
Que:6- Spottings based on: a) Identify and describe: GPS/Binocular/Plankton collection Net/camera b) Identify and describe: Pug mark/bio-geographical distribution of endangered species from India (any 01 from journal) c) Identify and describe: IUCN categorization of given fauna / air breathing organs in fish-(any one from journal) d) Identify and describe morphology & economic importance of fish /types of castes of honey-bee/poultry & dairy breeds (chart/photo)-Any 01 from journal e) Identify and describe: any 01 cast or gear from journal	**10**
Que:7- a) Excursion/Study Tour:- Visit to any National Parks/ Zoo parks / visit to any fish farm/ pisciculture unit/or Lab./marine water / freshwater habitat / Wildlife Sanctuaries / National or State Research Institutes / University departments / or other appropriate Institutes//poultry/dairy/sericulture units. OR	**10**

b) Review of research work / student research publication: Review of 10 research papers related to zoology or life science and to prepare a review articles of minimum 5-10 pages OR c) Publication of one research paper in a peer reviewed journal in collaboration with teacher (accepted/published or personated research paper in seminar/conferences/symposia and submission of copy of presented paper with certificate	
Que:8 Journal & Viva	**10**

Important Instructions:

-All necessary precautions must be taken while organizing study tour with special reference to the safety of students as per Higher Education rules and regulations.

Note:

-As per the guidelines of **UGC notification number F.14-6/2014(CPP-II) dated 1stAugust, 2014** it is now essential to make necessary modifications to stop dissection and promote and orient students towards the knowledge component rather than skill development. However, ITC based virtual dissections are promoted. Now, the responsibility to discontinue dissections and use of animals in experiments totally rests on concerned authorities of respective colleges/Institutes. As per the notification it is important to encourage the field trips and observations without disturbing the biodiversity. For laboratory observations existing permanent slides and specimens should be shown. As per the guidelines of UGC , all the Zoology departments should be empowered with infrastructure to adopt Information communication technology (ICT) required for the purpose of virtual dissections for which virtual class room / laboratory to be enriched with few computers (according to the strength of students),internet facility , printer etc.

Equivalence:

Paper no.	**Old CBCS**	**New CBCS w e f .2021-22**
	Semester-V	
Paper no. IX	Non-chordate	**NO- Equivalence**
Paper no. X	Biostatistics, bioinformatics, medical zoology, evolutionary biology and Biodiversity & Conservation Biology	**NO- Equivalence**
Paper no. XI	Comparative anatomy of chordates	**NO- Equivalence**
Paper no. XII	Developmental biology	**NO- Equivalence**

Semester-VI		
Paper no. XIII	Physiology	**DSE- 1B -Animal Physiology: Life Sustaining Systems (cc) - Equivalence**
Paper no. XIV	Endocrinology, environmental biology & toxicology	**NO- Equivalence**
Paper no. XV	Molecular Biology & Biotechnology	**DSE-1A -Molecular Biology (CC-Hon) Equivalence**
Paper no. XVI	Techniques in Biology **AND** Economic Zoology	**NO- Equivalence**

Chairman
(Board of studies in Zoology)