BENGALURU CITY UNIVERSITY

Palace Road, Bengaluru-560001

Syllabus for

B.Sc. ZOOLOGY (UG)

CHOICE BASED CREDIT SYSTEM (CBCS)

Framed According to the National Educational Policy (NEP 2020)

I – II SEMESTERS

To implement from the academic year 2021-22

Proceedings of the meeting of BOS in B. Sc Zoology of Bengaluru City University, Bengaluru.

Reference:

1. Constitution of BOS U.O dated 27.08. 2021
2. G.O. ED: 260/USH/2019(part-1), Bangalore dated 15.09.2021
3. BCU/BOS/204/2021 dated 27.09.2021

Adverting to above, the drafted syllabus prepared by Higher Educational Council (HEC), Government of Karnataka (GOK) pertaining to B. Sc Zoology was circulated by online mode (mailed by WA on 27.09.2021) to all the members of BOS, for scrutiny and approval.

Several Zoom meetings (26th , 29th,30th September and on 02nd October 2021) were held with members, to reach the final consensus on the given agenda, a formal meeting of the Board of Studies in Zoology of BCU was held on **04th October, 2021** at central college from 2.00-5.00 pm, Bengaluru Central University, Bangalore to scrutinize the drafted syllabus pertaining to B.Sc. Zoology (Bengaluru City University) in accordance with NEP-2020.

AGENDA 1: Approval of syllabus for B. Sc in Zoology under NEP-2020.

Resolution: The proposed syllabi for BSc in Zoology, both theory and practical as well as the scheme of the examination for I and II semesters are scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved on 4th October 2021.

AGENDA 2: Approval of panel of examiners for B. Sc in Zoology for the year 2021-22.

Resolution: The given panel of examiners for UG in Zoology for the year 2021-22 is scrutinized with appropriate inclusion(s) and deletion(s) of examiners and finally approved.

The meeting concluded with the chairman thanking all the members for the cooperation.

Members present

Dr. P. Mahaboob Basha

T. Tulasipati Naidu ABSENT

Dr. Srivatsa S

Dr. Ganesh U

Dhanalakshmi.

Dr. Ashoka CH

Dr. Hemalatha A

Chandrappa

Dr.SHUBHA M

Dr. C.E. Triveni

(P. MAHABOOB BASHA)
Chairman- BOS in Zoology

Syllabus for B.Sc., Hons in Zoology

Name of the Degree Program: **B. Sc., Hons**
Discipline Core: **Zoology**
Total Credits for the Program: **50/100/142/184/268**
Starting year of implementation: **2021-22**

Progressive Certificate, Diploma, Bachelor Degree or Bachelor Degree with Honours Provided at the End of Each Year of Exit of the Four-year Undergraduate Programme/ Five-year Integrated Master's Degree Programme

Introduction

The NEP-2020 offers an opportunity to effect paradigm shift from a teacher-centric to student-centric higher education system in India. It caters skill based education where the graduate attributes are first kept in mind to reverse-design the programs courses and supplementary activities to attain the graduate attributes and learning attributes. The learning outcomes-based curriculum framework for a degree in B.Sc. (Honours) Zoology is intended to provide a comprehensive foundation to the subject and to help students develop the ability to successfully continue with further studies and research in the subject while they are equipped with required skills at various stages. Effort has been made to integrate use of recent technology and use of MOOCs to assist teaching-learning process among students. The framework is designed to equip students with valuable cognitive abilities and skills so that they are successful in meeting diverse needs of professional careers in a developing and knowledge-based society. The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Zoology and allied courses, as well develop scientific orientation, spirit of enquiry problem solving skills and human and professional values which foster rational and critical thinking in the students. This course serves as plethora of opportunities in different fields right from classical to applied Zoology.

GRADUATE ATTRIBUTES IN B.Sc. (Hons.) ZOOLOGY

Some of the characteristic attributes a graduate in Zoology should possess are:

- Disciplinary knowledge and skills:
- Skilled communication:
- Critical thinking and problem solving capacity:
- Logical thinking and reasoning:
- Team Spirit & Leadership Quality:
- Digital efficiency:
- Ethical awareness / reasoning:
- National and international perspective:
- Lifelong learning

Flexibility

- The programmes are flexible enough to allow liberty to students in designing them according to their requirements. Students may choose a single Major, one Major or two Majors during third year (5th semester onwards). Teacher Education or Vocational courses may be chosen in place of Minor/s. Below listed are the various options students may choose from.

- One discipline, Two Languages, Generic Electives, Ability Enhancement, Skill Development

and Vocational courses including Extracurricular Activities.

- One discipline along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities

AIMS AND OBJECTIVES OF UG PROGRAM IN ZOOLOGY

- The Programme offers both classical as well as modern concepts of Zoology in higher education.
- It enables the students to study animal diversity in both local and global environments.
- To make the study of animals more interesting and relevant to human studies more emphasis is given to branches like behavioral biology, evolutionary biology and economic Zoology.
- More of upcoming areas in cell biology, genetics, molecular biology, biochemistry, genetic engineering and bioinformatics have also been included.
- Equal importance is given to practical learning and presentation skills of students.
- The lab courses provide the students necessary skills required for their employability.
- Skill enhancement courses in classical and applied branches of Zoology enhance enterprising skills of students.
- The global practices in terms of academic standards and evaluation strategies.
- Provides opportunity for the mobility of the student both within and across the world.
- The uniform grading system will benefit the students to move across institutions within India to begin with and across countries.
- It will also enable potential employers in assessing the performance of the candidates across the world.

Weightage for assessments

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	40	60
Practical	25	25
Projects*	45	105
Experiential Learning (Internships etc.)		

*In lieu of the research Project, two additional elective papers/ Internship may be offered

Credit distribution for the course

IIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka

Semester	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective(DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (Credits) (L+T+P)		Skill Enhancement Courses (SEC)		Total Credits
					Skill based (Credits) (L+T+P)	Value based (Credits) (L+T+P)	
I	Discipline A1-(4+2) Discipline B1-(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs. each)		SEC-1: Digital Fluency (2) (1+0+2)	Physical Education for Health &Wellness fitness(1)(0+0+2)(1) (0+0+2)	25
II	Discipline A2- (4+2) Discipline B2- (4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs. each)	Environmental Studies (2)		Physical Education - NCC/NSS/R&R(S&	25
Exit option with Certificate (50 credits)							
III	Discipline A3- (4+2) Discipline B3- (4+2)	OE-3 (3)	L1-3(3), L2-3(3) (4 hrs. each)		SEC-2: Artificial Intelligence (2)(1+0+2)	Physical Education- NCC/NSS/R&R(S&	25
IV	Discipline A4- (4+2) Discipline B4- (4+2)	OE-4 (3)	L1-4(3), L2-4(3) (4 hrs. each)	Constitution of India (2)		Physical Education - NCC/NSS/R&R(S&	25
Exit option with Diploma in Science (100 credits) OR Choose any one of the core subjects as Major and the other as Minor							
V	Discipline A5-(3+2) Discipline A6-3+2) Discipline B5-(3+2)	Vocational-1 (3)			SEC-3: SEC such as Cyber Security (2) (1+0+2)		20
VI	Discipline A7-(3+2) Discipline A8-(3+2) Discipline B6-(3+2)	Vocational-2 (3) Internship (2)			SEC-4: Professional Communication (2)		22
Exit option with Bachelor of Science Degree, B. Sc. Degree in Zoology (142 credits) or continue studies with the Major in the third year							
VII	Discipline A9-(3+2) Discipline A10-(3+2) Discipline A11-(3)	Zoology E-1 (3) Zoology E-2 (3) Res. Methodology (3)					22
VIII	Discipline A12-(3+2) Discipline A13-(3) Discipline A14-(3)	Zoology E-3 (3) Research Project (6)*					20
Award of Bachelor of Science Honours Degree, B.Sc.(Hons.) Degree in Zoology (184 credits)							

SEMESTER WISE CURRICULUM STRUCTURE OF COURSES

[*Note: As per the BOS decision Only B1 & B2 are followed as core subjects in Zoology for I and II semesters for the academic year 2021-22]

Semester	Name of the course/credits	What all program outcomes the course addresses (not exceeding 3 /course)	Pre- requisite course(s)	Concurrent course	Pedagogy	Assessment
I Semester A1 Core	Cytology, Genetics and Infectious Diseases (4)	1. The structure and functions of animal cell, cell organelles, cell- cell interactions, process of reproduction leading to new organisms. 2. The principles of inheritance, Mendel's laws and the deviations. 3. Inheritance of chromosomal aberrations in	Student must have studied Biology or equivalent subjects in Class 12.	Lab on Cell Biology and Genetics (2)	Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Problem Solving/Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of pedagogy,
I Semester B1* Core	Biology of Non-Chordates (4)	1. Learn the systematics and biology of non-chordates through their adaptive features. 2. Study the functional biology of non-chordates through their body organization. 3. Comprehend identification of species and their evolutionary relationships.	Student must have studied Biology or equivalent subjects in Class 12.	Lab on Biology of Non- Chordates (2)	Lectures/Videos/ Seminars/Case study/Project/ Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of pedagogy,
I Semester OE1Open Elective course	Economic Zoology (3)	1. Acquaint the knowledge about basic procedure and methodology of integrated animal rearing. 2. Students can start their own business i.e. self- employments. 3. Get employment in different sectors of Applied Zoology	Student must have studied Biology or equivalent subjects in Class 12.		Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Problem Solving/Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of pedagogy,
SEC 1 Skill Enhancement course	**SEC 1 Digital fluency** Vermiculture (2)		Student must have studied Biology or equivalent subjects in Class 12.		Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Problem Solving/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,

2 Semester A2	Biochemistry and Physiology (4)	1. In depth understanding of structure of biomolecules like proteins, lipids and carbohydrates. 2. The thermodynamics of enzyme catalyzed reactions. 3. To know various physiological processes of animals.	Student must have studied Biology or equivalent subjects in Class 12.	A2 Lab on Biochemistry, Physiology and Hematology (2)	Lectures/Videos/ Seminar/Case study/Project/ Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy
2 Semester B2*	Biology of Chordates (4)	1. Learn the systematics and biology of Chordates through their adaptive features. 2. 2.Study the functional biology of Chordates through their body organization. 3. Comprehend identification of Chordate species and their evolutionary relationships.	Student must have studied Biology or equivalent subjects in Class 12.	Lab on Biology of Chordates (2)	Lectures/Videos/ Seminar/Case study/Project/ Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
2 Semester OE2 Open Elective course	Parasitology(3)		Student must have studied Biology or equivalent subjects in Class 12.		Lectures/Videos/ Seminar/Case study/Project/ Formative Assessment/	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
2 Skill Enhancement course	**Environmental Studies** Sericulture (2)	1. Sericulture is an agro- based industry which gives economic empowerment to the students. 2. Sericulture may be taken up as a small scale industry by the small farmers and unemployed youth. 3. Get jobs in teaching	Student must have studied Biology or equivalent subjects in Class 12.		Lectures/Videos/ Seminar/Case study/Project/ Formative Assessment/ Summative Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
EXIT OPTION WITH CERTIFICATE (50 CREDITS)						

3. A3 Core Course	Molecular Biology Bioinstrumentation & Techniques in Biology (4)	Certificate Course in Zoology	Lab on Molecular Biology, Bioinstrumentation & Techniques in Biology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/ Formative Assessment/ Summative Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
3B3 Core Course	Comparative Anatomy and Microanatomy (4)	Certificate Course in Zoology	Lab on Comparative Anatomy and Microanatomy (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,

3OE-3 Open Elective course	Endocrinology (3)	Certificate Course in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
3 Semester Skill Enhancemen t course	**SEC 3 Artificial Intelligence** Apiculture (2)	Certificate Course in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
4 A4 Core curse	Gene Technology, Immunology and Computational Biology (4)	Certificate Course in Zoology	Lab on Genetic Engineering And Counselling (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
4 B4 Core Course	Cell Biology and Genetics (4)	Certificate Course in Zoology	Lab on Cell Biology and Genetics (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
4 Sem OE 4 Open Elective Course	Animal Behavior (3)	Certificate Course in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
4 Semester Skill Enhancement course	**Constitution of India (2)** Poultry	Certificate Course in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
EXIT OPTION WITH DIPLOMA (100 CREDITS)					
5 A5 Major Core Course	Non-Chordates and Economic Zoology (4)	Diploma in Zoology	Lab on Non-Chordates and Economic Zoology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
5 A6 Major Core Course	Chordates and Comparative Anatomy (3)	Diploma in Zoology	Lab on Chordates (Virtual Dissection) and Comparative Anatomy (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy.
5 B5 Minor Core Course	Animal Physiology and Anin Biotechnology (3)	Diploma in Zoology	Lab on Animal Physiology and Animal Biotechnology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment.	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy.
5 DSEC1	Vocational -1 Aquatic Biology (3)	Diploma in Zoology		Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy.

5 SEC 3 Skill Enhancement course	Cyber Security Integrated Animal Rearing (2)	Diploma in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
6 A7 Major Core Course	Evolutionary and Developmental Biology (3)	Diploma in Zoology	Lab on Evolutionary and Developmental Biology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Institute/Formative Assessment/ Summative Assessment.	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy.
6 A8 Major Core Course	Environmental Biology, Wildlife management and Conservation (3)	Diploma in Zoology	Lab on Environmental Biology, Wildlife management and	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
6 B6 Minor Core Course	Animal Behavior (3)	Diploma in Zoology	Lab on Animal Behaviour (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment.	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy.
DSEC	Vocationa-2 Entomology-3 Internship (2)	Diploma in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
6 Skill Enhancemen t Course	SEC 4 **Professional Communication** Fish Culture (2)	Diploma in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
EXIT OPTION WITH B. Sc. DEGREE (142 CREDITS)					
7 A9 Major Core Course	Ethology (3)	Degree in Bachelor Of Science in Zoology	Lab on Ethology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
7 A8 Major Core Course	Evolution and Zoogeography (3)	Degree in Bachelor Of Science in Zoology	Lab on Evolution and Zoogeography (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Zoo/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
7A9 Major Core Course	Genetics and Computational Biology (3)	Degree in Bachelor Of Science in Zoology	Lab on Advanced Genetics and Computational Biology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
7	Research methodology (3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to research lab/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,

7 DSEC	**Zoology E-1 (3)** Radiation Biology	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
7DSEC	Zoo Management **Zoology E-2 (3)**	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
8 A12 Major Core Course	Immunology and Stem Cell Biology (3)	Degree in Bachelor Of Science in Zoology	Lab on Immunology and Stem Cell Biology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
8A13 Major Core Course	Advanced Molecular Biology and Biostatistics (3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
8A 14 Major Core Course	Genomics and Proteomics (3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
8	**RESEARCH PROJECT (6)**	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
8DSEC1	*Any one of the below 4 choice* E-3 Neurosciences (3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
8DSEC2	E-3 Parasitology(3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
8DSEC3	E-3 Animal Experimentation and Ethics(3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
8DSEC4	E-3 Behavioral Biology(3)	Degree in Bachelor Of Science in Zoology		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,

EXIT OPTION WITH B. Sc. HONOURS DEGREE (184 CREDITS)					
9 A15 Major Core Course	Animal Biotechnology and Genetic Engineering (3)	Degree in Bachelor of Science Honors	Lab on Animal Biotechnology and Genetic Engineering (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
9 A 16 Major Core Course	Microanatomy Histochemistry and Histopathology (3)	Degree in Bachelor of Science Honors	Lab on Microanatomy, Histochemistry and Histopathology (2)	Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
9 A 17 Major Core course	Molecular Endocrinology (3)	Degree in Bachelor of Science Honors	Lab on Molecular Endocrinology (2)	Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Lab/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
9 A18.	Research methodology (3) of 7th sem) Applied Zoology .	Degree in Bachelor of Science Honors.		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment.	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy..
9DSEC1	E-1 Animal Biotechnology (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
9DSEC2	E-1 Toxicology (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
9 Skill Enhancement Course	Cattle Farming (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of Heutagogy,
10 A 19 Major	Physiology of Reproduction (3)	Degree in Bachelor of Science Honors	Lab on Reproductive Physiology (2)	Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment /Evaluation/ Analysis of result/ Application of Heutagogy.
10 A 20 Major	Developmental Biology (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
10 A 21 Major	Chronobiology (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Lab/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,

10 A 22	Nano Biotechnology (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,

10 DSEC 1	research project or any two dsec or internship (6)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
10 DSEC 2	E-3 Insect Vector & Diseases (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
10 DSEC 3	E-3 Human Physiology (3)	Degree in Bachelor of Science Honors		Lectures/Videos/ Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy
10 DSEC 4	E-3 Food, Nutrition & Health (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
10 Skill Enhancement	E-3 Animal Breeding Techniques (3)	Degree in Bachelor of Science Honors		Lectures/Videos / Seminars/Case study/Project/ Group discussion/Visit to Industry/Formative Assessment/ Summative Assessment	Formative and Summative Assessment/Evaluation/ Analysis of result/ Application of Heutagogy,
EXIT OPTION WITH M. Sc. DEGREE (268 CREDITS)					

Semester I- Zoology Core
Course Content:

Semester: **I Semester, B. Sc., (Hons) Zoology**

Course Title: **BIOLOGY OF NON-CHORDATES**	Course Code: **DSCC5Z00T1**
Course Type: **Discipline Core Theory, L-T-P: 4-0-0**	Course Credits: **4**
Total Contact Hours: **56**	Duration of ESA: **4 Hrs.**
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Learn the structural biology of non-chordates through their adaptive features.
2. Study the functional biology of non-chordates through their body organization and its function.
3. Comprehend identification of species and their evolutionary relationships.
4. Enhancement of research skills like critical thinking.
5. Develop abilities required for industrial employment as well as self-employment.

Course Content	Hrs.
Unit I	**14**
Chapter 1. Animal Architecture- Body symmetry- asymmetry, radial, biradial and bilateral symmetry with suitable example and Significance. Body organization- Protoplasmic, cellular, tissue and organ level of organization with suitable examples and Significance. Diploblasty (apparent and absolute) and Triploblasty with suitable Examples and Significance. Coelom- Acoelom, Pseudocoelom, and Eucoelom with suitable examples and Significance. Metamerism- Pseudometamerism (Strobilization), Eumetamerism with suitable examples and Significance. Cephalization- origin and significance.	
Chapter 2. General characters and classification of major Invertebrate phyla- Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca and Echinodermata up to the level of classes with suitable examples.	
Unit II	**14**
Chapter 3. Diversity of life sustaining systems in non-chordates: (with an example for each type of system) Locomotion: Protozoa- amoeboid (Sol-Gel theory), Flagellar, euglenoid and ciliary movements. Hydrostatic movements in Annelida-Earthworm and Echinodermata-starfish. Nutrition: In Protozoa. Feeding apparatus and mechanism: In Annelida-filter feeding, Arthropoda-Prawn, Mollusca-Pila and Echinodermata-Sea Star. Respiration: In Protozoa-diffusion, Helminthes-parasitic, Annelida-cutaneous, Arthropoda (any one type), Mollusca (Gill) and Echinodermata (Dermal papillae and Tube feet). Circulation: In Protozoa (cyclosis), Annelida- Earthworm, Arthropoda-Prawn, Mollusca-Pila and Echinodermata- Sea Star. Osmoregulation and excretion: In Protozoa-Contractile vacuoles, Platyhelminthes- Flame cells, Annelida-Nephridia and Arthropoda-Green glands.	

Unit III	14
Chapter 4. Diversity of coordinating systems and generative systems in non-chordates: (with an example for each type of system) Nervous system in Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca and Echinodermata. Neuroendocrine system and pheromones in Insecta. Sense organs: Mechanoreceptors, Photoreceptors, Chemoreceptors, thigmoreceptors, rheoreceptors and proprioreceptors. Reproduction: Asexual and sexual reproduction in Protozoa, Porifera, Coelenterata, Annelida and Echinodermata. Metamorphosis in Insecta. Larval forms of Coelenterata, Annelida and Echinodermata.	
Unit IV	**14**
Chapter 5. Beneficial non-chordates: Non-chordates used as food; Arthropoda and Mollusca. Non-chordates in Industry and Industrial products; Silkworm-silk, Lac Insect-shellac, Honey bees-bee wax, Pearl Oysters- pearls, Corals, sponges, shells dyes and pigments. Non-chordates in medicinal Use-Leeches, Maggot larva and honey bee and products. Non-chordates in agriculture-earthworms, pollinators and pest controllers. Non-chordates in food chain and as scavengers. **Chapter 6.** Harmful non-chordates Parasitic Platyhelminthes. Soil Nematodes. Agricultural, veterinary and human pests of Arachnida. Agricultural, veterinary and human pests of Arthropoda.	07 07

Topics Suggested for Assignment/ Formative Assessment:

1. Animal connecting links. 2. Polymorphism 3. Parasitic adaptations 4. Metamorphosis 5. Freshwater sponges 6. Molluscans of industrial value 7. Coral reefs and their role in ecosystem generation 8. Invertebrate minor phyla. 9. Regeneration in sponges and *Planaria.* 10. Soil and water protozoa.

Recommended Books:

1. Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: A Synthesis, Blackwell Publishing.
2. Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
3. Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
4. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. and Nelson.
5. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
6. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.

Web Sources:

Animal Diversity (https://swayam.gov.in/courses/5686-animal-diversity)
Advances in Animal Diversity, Systematics and Evolution (https://swayam.gov.in/courses/5300-zoology)
ePGPathshala (MHRD) Module 10, 18, 19 of the paper P-08 (Biology of Parasitism) https://epgp.inflibnet.ac.in/ahl.php?csrno=35

Pedagogy: Lectures, Presentations, videos, Assignments and Weekly Formative Assessment Tests.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/ Field Report/ Project	15 Marks
Test	20 Marks
Participation in class	05 marks
Total	**40 Marks**

Semester: I

Course Lab Content

Course Title: **Lab on BIOLOGY OF NON-CHORDATES**	Course Credits: **02**
Course Type: **Minor Discipline Core Practical, L-T-P: 0-0-4**	Corse Code: **DSCC5Z00P1**
Total Contact Hours: **56**	Duration of ESA: 4 **Hours**
Formative Assessment Marks: **25**	Summative Assessment Marks: **25**
Model Syllabus Authors:	

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand basics of classification of non-chordates.
2. Learn the diversity of habit and habitat of these species.
3. Develop the skills to identify different classes and species of animals.
4. Know uniqueness of a particular animal and its importance
5. Enhancement of basic laboratory skill like keen observation and drawing.

Course Content

List of experiments to be conducted	Hours
1. Preparation and observation of protozoan culture. 2. **Protozoa**: Systematics of *Amoeba*, *Euglena*,*Noctiluca*, *Paramecium* and *Vorticella* (Permanent slides). 3. **Porifera:** Systematics of *Sycon, Euplectella, Hyalonema, Spongilla*and *Euspongia*(Specimens). Study of permanent slides of T.S of *Sycon*, spicules and gemmules. 4. **Cnidaria:** Systematics of *Aurelia* and *Metridium*(Specimens). Slides of *Hydra*, *Obelia*-polyp and medusa, and *Ephyra* larva, T.S. of *Metridium*passing through mesenteries. 5. **Study of Corals**-*Astraea, Fungia, Meandrina, Corallium, Gorgonia, Milleporaand Pennatula.* 6. **Helminthes:** Systematics of Planaria, Fasciola hepatica and Taenia solium, Ascaris- Male and female(Specimens). Slides of T.S. of Planaria, T.S of male and female Ascaris, 7. **Annelida:** Systematics of Nereis, Hetero nereis, Sabella, Aphrodite (Specimens). Slide of T.S. of Earth worm through typhlosole. 8. **Arthropoda:** Systematics of Penaeus, Palaemon, Astacus, Scorpion, Spider, Limulus, Peripatus, Millipede, Centipede, Praying mantis, Termite Queen, Moth, Butterfly, Dung beetle/ Rhinocerous beetle (Any six specimens). Slide of Larvae-Nauplius, Zoea, Mysis. 9. **Mollusca:** Systematics of Chiton, Mytilus, Aplysia, Pila, Octopus, Sepia, Glochidium larva (Specimens). 10. **Shell Pattern**-Unio, Ostrea, Cypria, Murex, Nautilus, Patella, Dentalium, Cuttle bone. 11. **Echinodermata:** Systematics of Sea star, Brittle star, Sea Urchin, Sea cucumber, Sea lilly (Specimens). Slide of Bipinnaria larva, Echinopluteus larva and Pedicellaria. 12. **Harmful Nonchordates:** Soil Nematodes. Agricultural, veterinary and human pests of Arachnida. Agricultural, veterinary and human pests of Arthropoda. **Beneficial Nonchordates:** 13. **Sericulture:** Life cycle of Bombyx mori, Uzi fly, Cocoon, Raw silk. 14. **Apiculture:** Any 2 Species of honey bee, bee wax. 15. **Pearl Culture:** Pearl Oyster and Natural Pearls. 16. **Virtual Dissection/Cultured specimens:** Earthworm – Nervous system Leech-Digestive System 17. **Virtual Dissection/ Cultured specimens:** Prawn - Nervous system. Cockroach-*Salivary Apparatus and Digestive system.*	56

Recommended Books:

1. Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
2. Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) AnimalDiversity, McGraw- Hill.
3. Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, OxfordUniversity Press.
4. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S.and Nelson.
5. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia PublishingHome.
6. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.

Web References:

Anatomy of earthworm: The dissection works (CD); www.scienceclass.com, www.neosci.com
Cockroach dissection- www.ento.vt.edu

Pedagogy: Lectures, Presentations, videos, Labs, Assignments, Tests, Individual or group Field oriented Project Report on, Visit to one research institute/ one wild life sanctuary / museum / zoo.

TOPICS RECOMMENDED FOR PROJECT/ MONOGRAPH PREPARATION

General account of Protozoan ooze.
Monograph on Sea anemones.
Monograph on Polychaetes.
Monograph on Leeches.

Pedagogy: Lectures, Presentations, videos, Assignments and Weekly Formative Assessment Tests.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/Monograph	10
Test	10
Participation in class	05
Total	**25**

Open Elective Course Content

I Semester

Course Title: **Economic Zoology** Course Code: **OEC5ZOOT1**	Course Credits:**3**
Total Contact Hours: **42**	Duration of ESA: 3 Hours
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**

Course Outcomes

At the end of the course the student will be able to:

1. Gain knowledge about silkworms rearing and their products.
2. Gain knowledge in Bee keeping equipment and apiary management.
3. Acquaint knowledge on dairy animal management, the breeds and diseases of cattle and learn the testing of egg and milk quality.
4. Acquaint knowledge about the culture techniques of fish and poultry.
5. Acquaint the knowledge about basic procedure and methodology of Vermiculture.
6. Learn various concepts of lac cultivation.
7. Students can start their own business i.e. self-employments.
8. Get employment in different applied sectors

Course Content

Content	Hrs.
Unit I	**14**
Chapter 1. Sericulture: • History and present status of sericulture in India • Mulberry and non-mulberry species in Karnataka and India • Mulberry cultivation • Morphology and life cycle of *Bombyx mori* • Silkworm rearing techniques: Processing of cocoon, reeling • Silkworm diseases-pests and their control **Chapter 2. Apiculture:** • Introduction and present status of apiculture • Species of honey bees in India, life cycle of *Apis indica* • Colony organization, division of labour and communication • Bee keeping as an agro based industry; methods and equipments: indigenous methods, extraction appliances, extraction of honey from the comb and processing • Bee pasturage, honey and bees wax and their uses • Pests and diseases of bees and their management	
Unit II	**14**
Chapter 3. Live Stock Management: • **Dairy:** Introduction to common dairy animals and techniques of dairy management • Types, loose housing system and conventional barn system; advantages and limitations of dairy farming • Establishment of dairy farm and choosing suitable dairy animals-cattle • Cattle feeds, milk and milk products • Cattle diseases • **Poultry:** Types of breeds and their rearing methods • Feed formulations for chicks • Nutritive value of egg and meat • Disease of poultry and control measures **Chapter 4. Aquaculture:** • Aquaculture in India: An overview and present status and scope of aquaculture • Types of aquaculture: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture	

Unit - III	14
Chapter 5. Fish culture: • Common fishes used for culture. • Fishing crafts and gears. • Ornamental fish culture: Fresh water ornamental fishes- biology, breeding techniques • Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. control of snail and algal growth. • Modern techniques of fish seed production **Chapter 6. Prawn culture:** • Culture of fresh and marine water prawns. • Preparation of farm. • Preservation and processing of prawn, export of prawn. **Chapter 7. Vermiculture:** • Scope of Vermiculture. • Types of earthworms. • Habit categories - epigeic, endogeic and anecic; indigenous and exotic species. • Methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of Vermicompost. • Advantages of vermicomposting. Diseases and pests of earthworms.	
Chapter 8. Lac Culture: • History of lac and its organization, lac production in India. Life cycle, host plants and strains of lac insect. • Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac. • Lac composition, processing, products, uses and their pests	

.Text Books & Suggested Readings:

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, Kindle Edition.
7. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
8. YadavManju (2003). Economic Zoology, Discovery Publishing House.
9. JabdePradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Cherian &Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
11. Sathe, T.V. Vermiculture and Organic farming.
12. Bard. J (1986). Handbook of Tropical Aquaculture.
13. Santhanam, R. A. Manual of Aquaculture.
14. Zuka. R.I and Hamiyn (1971). Aquarium fishes and plants
15. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
16. Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014
17. Economics Of Aquaculture - Singh (R.K.P) - Danika Publishing Company 2003
18. Applied and Economic Zoology (SWAYAM) web https://swayam.gov.in/nd2_cec20_ge23/preview

Course Books published in English and Kannada may be prescribed by the Universities and Colleges

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Field visit

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	15
Written Assignment/Presentation/Project / Term Papers/Seminar	20
Class performance/Participation	05
Total	**40**

Skill Enhancement Course in Zoology

Course Content

Semester: I

Course Title: Vermiculture **Course Code: VEC5ZOOP1**	**Course Credits: 2**
Total Contact Hours: 56 Hours	Duration of ESA: **4** Hrs.
Formative Assessment Marks: 20	Summative Assessment Marks: **30**
Model Syllabus Authors:	

Course Outcomes (COs):

At the end of the course the student:

1. Understands the importance of earthworms in maintaining soil quality.
2. Learns that the vermicomposting is an effective organic solid waste management method.
3. Gets acquainted with the importance of earthworms in agro-based economic activity.
4. Vermicomposting leads to organic farming and healthy food production.
5. Vermicomposting may be taken up as a small scale industry by the farmers and unemployed youth.
6. Get jobs in teaching institutions or Vermiculture units as technicians.
7. Learn the concept of vermicomposting as bio fertilizers thus student can become an entrepreneur after completion of the course.
8. Best opportunity for self-employment and lifelong learning with farmers.

Course Content

	List of labs to be conducted	56Hr
1	Collection of native earth worm species to study habit and habitat.	
2	Keys to identify different species of earth worm.	
3	Externals and Life cycle of ***Eisenia fetida*** and ***Eudrilus eugeniae.***	
4	Dissection of digestive and reproductive system.	
5	Study of vermicomposting equipments and devices.	
6	Preparation of vermi beds and their maintenance.	
7	Study of different vermicomposting methods.	
8	Harvesting, separation of worms, packaging, transport and storage of Vermicompost.	
9	Vermi-wash collection and processing.	
10	Small scale earth worm farming for home gardens and studying the effect of Vermicompost on garden plants.	
11	Budget and cost scenario of Vermiculture (Project).	
12	Diseases and natural enemies of earth worms and their control measures.	
13	Role of vermitechnology in environmental protection.	
14	Economics and Marketing of Vermicompost and vermi wash.	
15	Visit to Vermiculture farm to acquaint with latest techniques.	

Text Books and references

1. Bhatt J.V. & S.R. Khambata (1959) -Role of Earthworms in Agriculture‖ Indian Council of Agricultural Research, New Delhi
2. Edwards, C.A. and J.R. Lofty (1977) -Biology of Earthworms‖ Chapman and Hall Ltd., London.
3. Lee, K.E. (1985) -Earthworms: Their ecology and Relationship with Soils and Land Use‖ Academic Press, Sydney.
4. Dash, M.C., B.K. Senapati, P.C. Mishra (1980) — Verms and Vermicomposting‖ Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.
5. Kevin, A and K.E. Lee (1989) — Earthworm for Gardeners and Fisherman‖ (CSIRO, Australia, Division of Soils)
6. Satchel, J.E. (1983) -Earthworm Ecology‖ Chapman Hall, London.
7. Wallwork, J.A. (1983) -Earthworm Biology‖ Edward Arnold (Publishers) Ltd. London.

Pedagogy

1. Demonstration
2. Assignment
3. Group discussion
4. Field visit
5. Use of Audio-Visual aids.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Class Test	10
Attendance and Assignments	05
Visit to Vermicompost unit and report	05
Total	**20**

Semester II- Zoology
Core Course Content:

Semester: II Semester B. Sc., (Hons) Zoology **Core course**

Course Title: **PAPER I-BIOLOGY OF CHORDATES**	Course Code: **DSCC5Z00T2**
Course Type: **Discipline Core Theory, L-T-P: 4-0-0**	Course Credits: **4**
Total Contact Hours: **56**	Duration of ESA: **4 Hrs.**
Formative AssessmentMarks:**40**	Summative Assessment Marks: **60**
Model Syllabus Authors:	

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Learn the structural biology of Chordates through their adaptive features.
2. Study the functional biology of Chordates through their body organization and functions.
3. Comprehend the identification of species and their evolutionary relationships.
4. Enhancement of research skills like critical thinking.
5. Develop abilities required for industrial employment as well as self-employment.

Course Content	Hrs
Unit I	**14**
Chapter 1: Hemichordata: Type Study of *Balanoglossus* – Habit and Habitat, Morphology, Coelom. Tornaria larva and its affinities. Affinities and systematic position of Hemichordata. **Chapter 1: Chordates:** Origin of Chordates. Basic characters of chordates and classification up to classes. **Chapter 3: Urochordata:** Type Study of *Herdmania*-Habit and Habitat, Morphology, Ascidian tadpole- structure and its retrogressive metamorphosis. **Chapter 4: Cephalochordata:** Type Study of *Branchiostoma* (Amphioxus)-Habit and Habitat, Morphology, Digestive system, Feeding mechanism and circulatory system. **Chapter 5: Agnatha** General characters of Agnatha and classification up to classes. Salient features of Cyclostomata and Ostracodermi with orders and examples. Ammocoete larva and its significance.	
Unit II	**14**
Chapter 6: Vertebrates: General characters and Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia, Aves, Mammalia) up to the order with examples. General characters of Chondrichthyes and Osteichthyes. Interesting features and evolutionary significance of Dipnoi. Salient features of Placodermi with examples. Interesting features of *Sphenodon.* Interesting features of Archaeopteryx. Salient features of Ratitae and Carinatae with examples. Interesting features of mammalian orders (Insectivora, Carnivora, Chiroptera, Cetacea, Proboscidia, Ungulata – Perissodactyla and Artiodactyla, and Primates – Platyrhini and Catarhini) with examples.	

Unit III	14
Chapter 7: General account of Chordates: Types of caudal fins and tails in fishes. Osmoregulation and Swim bladder in Fishes. Origin of Amphibia. Neoteny and Pedogenesis. Adaptive radiation in extinct reptiles with suitable examples. Temporal fossae in reptiles. Poison apparatus and biting mechanism in snakes. Parental care in Pisces, Amphibians, Reptiles, Birds and Mammals. Dentition in mammals. Evolution of molar tooth. Migration in Pisces, Birds and Mammals. **Chapter 8: Type study of Rattus**: Morphology, Endoskeleton (Axial and appendicular skeleton, except hands and feet) Digestive system, circulatory system, reproductive system.	
Unit IV	**14**
Beneficial Chordates:	
Chapter 9: Pisciculture • Meaning of Aquaculture and Pisciculture, inland and marine fisheries. Inland Pisciculture – Procedure, composite fish farming and significance. A brief account of fishing gears and crafts. • Fish processing and preservation. **Chapter 10: Poultry** • Definition, breeds of Fowls. • Indigenous and exotic breeds with suitable examples. Poultry products and by-products. • Diseases of poultry – Ranikhet, Fowl pox, Fowl Cholera, Fowl Typhoid. **Chapter 11: Dairy** • Breeds of cattle: indigenous and exotic breeds. • Improvements in cattle breeding – artificial insemination, MOET. • Pasteurization and gobar gas. • Diseases in cattle- Foot and Mouth diseases, causes and effects.	

Topics Suggested for Assignment/ Formative Assessment:

1. Animal connecting links.
2. Migration in Birds
3. Communication in Primates
4. Parental Care in Animals
5. Neoteny 6. Pedogenesis
6. Poultry management
7. Dairy Management
8. Fisheries management
9. Products and by-products ofDiary.

Suggested Readings:

1. Harvey et al: The Vertebrate Life (2006)
2. Colbert et al: Colbert 's Evolution of the Vertebrates: A history of the back boned animals through time (5thed2002,Wiley-Liss)
3. Hildebrand: Analysis of Vertebrate Structure (4th ed. 1995, John Wiley)
4. Kenneth V .Kardong (2015) Vertebrates: Comparative Anatomy, Function, Evolution Mc Graw Hill
5. Mc Farland et al: Vertebrate Life (1979, Macmillan Publishing)
6. Parker and Haswell: Text Book of Zoology, Vol. II (1978, ELBS)
7. Romer and Parsons: The Vertebrate Body (6thed 1986, CBS Publishing Japan)
8. Young: The Life of vertebrates (3rded2006, ELBS/Oxford)
9. Weichert C.K and William Presch (1970). Elements of Chordate Anatomy, Tata Mc Graw Hills

Web Sources:

10. https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash course-biology-science/v/crash-course-biology-123
11. https://opentextbc.ca/biology2eopenstax/chapter/chordates/

Pedagogy: Lectures, Presentations, videos, Assignments and Weekly Formative Assessment Tests.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/ Field Report/ Project	15 Marks
Test	20 Marks
Participation in class	05 marks
Total	**40 Marks**

Semester: II Zoology Core

Course Lab Content

Course Title: **Lab on Biology of Chordates, L-T-P: 0- 0-4**	Course Credits: **2**
Total Contact Hours: 56	Duration of ESA: 4 **Hours**
Formative AssessmentMarks:**25**	Summative Assessment Marks: **25**

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand basics of classification ofChordates.
2. Learn the diversity of habit and habitat of animal species.
3. Develop the skills to identify different classes and orders of Chordates.
4. Know uniqueness of particular animal and its importance
5. Enhancement of basic laboratory skill like keen observation and drawing.

List of experiments to be conducted	56 Hrs
1. **Protochordata**: -Balanoglossus and its T. S through proboscis Ascidian/ *Herdmania* and *Amphioxus,* T.S. of *Amphioxus* through pharynx and intestine. 2. **Cyclostomata:** -*Petromyzon*, Ammocoete larva and *Myxine.* 3. **Pisces**: Cartilaginous Fishes – *Narcine, Trygon, Pristis, Myolobaties* Bony Fishes –Zebra fish, Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon, Echeneis. 4. **Ornamental fishes:** -Siamese, Koi, Oscar, Betta Sp., Neon tetra, Guppies, Gold fish, Angle fish, Rainbow fish, Mollies. 5. **Accessory respiratory organs** – Saccobranchus, Clarias and Anabas. 6. **Amphibia:** -Frog, Bufo, Ambystoma, Axolotl larva, Necturus and Ichthyophis. 7. **Reptilia**: -Turtle, Tortoise, Mabuya, Calotes, Chameleon, Varanus.	

snakes –Dryophis, Rat snake, Brahmini, Cobra, Krait, Russell 's viper and Hydrophis; Poison apparatus.

8. **Aves:**
   -Beak and feet modifications in the following examples: Duck, Crow, Sparrow, Humming bird, Parrot, King fisher, Eagle or Hawk.
9. **Mammalia:**
   -Mongoose, Squirrel, Pangolin, Hedge Hog, Rabbit, Rat, Monkey and Loris.
10. **Virtual Dissection/Cultured specimens:**
    -Shark/Bony fish: Afferent and efferent branchial systems, glossopharyngeal and vagus nerves.
11. **Virtual Dissection/Cultured specimens:**
    Frog: Origin and distribution of trigeminal nerve.
12. **Virtual Dissection/Cultured specimens:**
    -Rat: Dissection (only demonstration) – Circulatory system (arterial and venous), urinogenital system.
13. **Pisciculture:**
    Cultured varieties of fishes- fresh water and marine water fishes (locally available)
    Diseases- (Bacterial, viral, fungal and parasitic)
    Products and by products- (Meat, gelatin, Insulin, Isinglass, protein and chitin)
14. **Poultry**: Cultured varieties- Indigenous and exotic species.
    Diseases- Bacterial and viral.
    Products and by-products –Meat, Eggs, albumin flakes and manure.
15. **Dairy**: Cultured Varieties-Indigenous and exotic breeds.
16. **Diseases-** Infectious, hereditary and deficiency.
17. **Products and by-products** – Milk, Cheese, Yogurt.

Suggested Readings:

1. Harvey et al: The Vertebrate Life (2006)
2. Colbert et al: Colbert's Evolution of the Vertebrates: A history of the back boned animals through time (5th ed. 2002, Wiley-Liss)
3. Hildebrand: Analysis of Vertebrate Structure (4th ed.1995, John Wiley)
4. Kenneth V. Kardong (2015) Vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill
5. Mc Farl and et al: Vertebrate Life (1979, Macmillan Publishing)
6. Parker and Haswell: Text Book of Zoology, Vol. II (1978, ELBS)
7. Romer and Parsons: The Vertebrate Body (6th ed. 1986, CBS PublishingJapan)
8. Young: The Life of vertebrates (3rd ed. 2006, ELBS/Oxford)
9. Weichert C. K and William Presch (1970). Elements of Chordate Anatomy, Tata Mc Graw Hills

Web Sources:

1. https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crashncourse- biology-science/v/crash-course-biology-123
2. https://opentextbc.ca/biology2eopenstax/chapter/chordates/

Pedagogy: Lectures, Presentations, videos, Assignments and Weekly Formative Assessment Tests.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/Monograph	10
Test	10
Participation in class	05
Total	**25**

Semester: II Zoology

Open Elective Course Content

Course Title: **Parasitology** Course Code: **OEC5ZOOT2**	Course Credits:**3**
Total Contact Hours: **42**	Duration of ESA: 3 Hours
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**
Model Syllabus Authors:	

Course Outcomes (COs):

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

- Know the stages of the life cycles of the parasites and infective stages.
- Develop ecological model to know population dynamics of parasite, establishment of parasite population in host body, adaptive radiations and methods adopted by parasite to combat with the host immune system.
- Develop skills and realize significance of diagnosis of parasitic infection and treatment.
- Understand about diseases caused by Protozoa, Helminthes, Nematodes and Arthropods at molecular level.
- Develop their future career in medical sciences and related administrative services.

Course Content

Content	42Hrs
Unit – 1	
Chapter 1. General Concepts • Introduction, Parasites, parasitoids, host, zoonosis • Origin and evolution of parasites • Basic concept of Parasitism, Symbiosis, Phoresy, commensalisms and mutualism • Host-parasite interactions and adaptations • Life cycle of human parasites • Occurrence, mode of infection and prophylaxis **Chapter 2. Parasitic Platyhelminthes** • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Fasciolopsis buski* • *Schistosoma haematobium* • *Taenia solium* • *Hymenolepis nana* **Chapter 3. Parasitic Protists** • Study of morphology, life cycle, pathogenicity, prophylaxis and control *measures* of • *Entamoeba histolytica* • *Giardia intestinalis* • *Trypanosoma gambiense* • *Plasmodium vivax*	14

Unit – 2	**14**
Chapter 4. Parasitic Nematodes • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Ascaris lumbricoides* • *Ancylostoma duodenale* • *Wuchereria bancrofti* • *Trichinella spiralis* • Nematode plant interaction; Gall formation **Chapter 5. Parasitic Arthropods** • Biology, importance and control of • Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*) • Mites (*Sarcoptes*) • Lice (*Pediculus*) • Flea (*Xenopsylla*) • Bug (*Cimex*) • Parasitoid (Wasps) **Chapter 6. Parasitic Vertebrates** • Cookicutter Shark • Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host	
Unit – 3	**14**
Chapter 7. Molecular diagnosis & clinical parasitology • General concept of molecular diagnosis for parasitic infection • Advantages and disadvantages of molecular diagnosis • Fundamental techniques used in molecular diagnosis of endoparasites • Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules like G.intestinalis, B. coli, E. histolytica, L. donovani, Malarial parasite using • ELISA, RIA • Counter Current Immunoelectrophoresis (CCI) • Complement Fixation Test (CFT) PCR, DNA, RNA probe	

Suggested Readings:

- Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications.
- E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition.
- Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group.
- Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
- Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
- K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBSnP.
- Gunn, A. and Pitt, S.J. (2012). Parasitology: An Integrated Approach. Wiley Blackwell.
- Noble, E. R. and G.A.Noble (1982) Parasitology: The biology of animal parasites. V th Edition, Lea &Febiger.
- Paniker, C.K.J., Ghosh, S. [Ed} (2013). Paniker's Text Book of Medical Parasitology. Jaypee, New Delhi.
- Parija, S.C. Text Book of Medical Parasitology, Protozoology & Helminthology (Text and color Atlas),II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
- Roberts, L.S and Janovy, J. (2009). Smith & Robert 's Foundation of Parasitology. 8th. Ed.. McGraw Hill.

- Bogitsh, B. J. and Cheng, T. C. (2000). Human Parasitology. 2nd Ed. Academic Press, New York.
- Chandler, A. C. and Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley and Sons Inc.
- Cheng, T. C. (1986). General Parasitology. 2nd ed. Academic Press, Inc. Orlando. U.S.A.
- Schmidt, G. D. and Roberts, L. S. (2001). Foundation of Parasitology. 3rd ed. McGraw Hill Publishers.
- Schmidt, G. D. (1989). Essentials of Parasitology. Wm. C. Brown Publishers.
- John Hyde (1996) Molecular Parasitology Open University Press.
- J Joseph Marr and Miklos Muller (1995) Biochemistry and Molecular Biology of Parasites 2 nd Edn A P.

Course Books published in English and Kannada may be prescribed by the Universities and College

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Interaction, virtual lab, Lab visit

Formative Assessment	
Assessment Occasion	**Weighta**
House Examination/Test	**15**
Written Assignment/Presentation/Project / Term Papers/Seminar	**20**
Class attendance / Participation	**05**
Total	**40**

Semester: II Zoology

Skill Enhancement Course Content

Course Title: Sericulture Course Code: VEC5ZOOP2	Course Credits: 2
Total Contact Hours: 56 Hours	Duration of ESA: 3 Hrs.
Formative Assessment Marks: 25	Summative Assessment Marks: 25
Model Syllabus Authors:	

At the end of the course the student acquires the following knowledge:

1. Sericulture is an agro-based industry which gives economic empowerment to the students.
2. Sericulture may be taken up as a small scale industry by the small farmers and unemployed youth.
3. Get jobs in teaching profession, silk board and other Govt. institutions as technicians.
4. Student can be self-employed after successful completion of the course.

Course Outcomes (COs):

Course Content

	List of Lab to be conducted	42 Hrs
1	Morphology and taxonomy of mulberry.	
2	Raising of saplings – cutting preparation, planting and maintenance of nursery.	
3	Agronomical practices in mulberry cultivation-weeding, manuring, irrigation and harvesting.	
4	Diseases and pests of mulberry.	
5	Silk producing insects – non mulberry and mulberry silk worms.	
6	Life cycle and morphology of ***Bombyx mori.***	
7	Dissection of digestive system and silk glands of ***Bombyx mori.***	
8	Silk worm rearing equipments.	
9	Rearing process – incubation, chawki rearing, late age worm rearing, mounting and harvesting of cocoons.	
10	Silk worm diseases and pests – Grasserie, Flacherie, Muscardine, Pebrine, Uzi fly and Beetles.	
11	Grainages – production of silk worm eggs.	
12	Physical and commercial characteristics of cocoons.	
13	Reeling and weaving process – stiffling , cooking , brushing, reeling and re-reeling, different types of looms.	
14	Visit to mulberry farm and sericulture center.	
15	Economics of silk production (Project)	

Text Books and References

1. Govindan, R., Narayanswami, T. K and Devaiah, M.C.1998, Principles of silk worm pathology. Ser Publishers, Bangalore.
2. Tazima, Y.1964 -The genetics of the silk worm‖ Logos Press Ltd. London.
3. Tazima Y 1978 The silk worm an important laboratory tool Kodnasha Ltd. Tokyo.
4. Ganga G, SulochanaChetty J An introduction to sericulture Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi.
5. Ullal and Narasimhanna Hand book of practical sericulture.
6. FAO Mannuals on sericulture vol . 1-4.
7. Tazima Y 1958 Silkworm egg CSB Publication, Bombay.
8. Yashimoro Tanaka 1964 Sericology CSB Publication, Bombay.

Pedagogy

1. Demonstration
2. Assignment
3. Group discussion
4. Field Visit.
5. Use of Audio-Visual aids.

Formative Assessment	
Assessment Occasion	**Weightage**
Class Test	10
Attendance and Assignments	10
Visit to Mulberry Farm and Sericulture center.	05
Total	25

Course pattern and scheme of examination for B.Sc./ B.Sc. (Hons.) as per NEP (2021-22 onwards)

Subject: ZOOLOGY

SL No.	Semester	Title of the paper	Teaching hours	Hours / week		Examination Pattern Max. & Min. Marks /Paper						Duration of Exam (hours)		Total Marks / paper	Credits	
						Theory			Practical							
				Theory	Practical	Max.	MIN.	IA	Max.	MIN.	IA	Theory	Practical		Theory	Practical
1	I	CORE subject	56	4	4	60	22	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	22	40	-	-	-	3	3	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	3	3	50	-	2
2	II	CORE subject	56	4	4	60	22	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	22	40	-	-	-	3	3	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	3	3	50	-	2

Scheme of Internal Assessment Marks: Theory

Sl. No	Particulars	IA Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	20
3	Assignments /Seminar / Case Study / Project work / Reports on - Field visits made for observation and collection of data etc.,	15
	TOTAL Theory IA Marks	**40**

Scheme of Internal Assessment: Marks Practicals

Sl. No.	Particulars	IA Marks
1	Practical Test	05
2	Submission of Project Report	05
3	Viva-voce on project report	05
4	Active participation in practical classes (Attendance)	05
5	Practical Record(s)	05
	TOTAL Theory IA Marks	**25**

Scheme of Practical Examination
I Semester BSc. Zoology Core- Biology of Non-Chordates

Duration: 3 hours **Max. marks: 25**

1. Systematics: Identify, classify and comment on A to E (3 x 7=21 marks)
2. Observation of system/chart: Identify and describe the given specimen/chart 'F' with a neat labelled diagram. (04 marks)

TOTAL 25 Marks

Scheme of Practical Examination
I Semester BSc. Zoology
Skill Enhancement course: Vermiculture

Duration: 3 hours **Max. marks: 25**

1. Identify and describe the given system of the given specimen/chart 'A' given, with neat labelled diagram. (05 marks)
2. Identify and comment on the spotters B to E (Life cycle/Externals/Devices used in vermicomposting/ Vermicompost types) (4x5=20 marks)

TOTAL = 25 Marks

SCHEME OF PRACTICAL EXAMINATION
II Semester BSc. Zoology Core
Biology of Chordates

Duration: 3 hours **Max. marks: 25**

1. Systematics: Identify, classify and comment on A to E (3x7=21 marks)
2. Observation of system/chart: Identify and describe the given specimen/chart 'F' with a neat labelled diagram. (04 marks)

TOTAL = 25 Marks

SCHEME OF PRACTICAL EXAMINATION
II Semester BSc. Zoology
Skill Enhancement course: Sericulture

Duration: 3 hours **Max. marks: 35**

1. Identify & describe the system of the given specimen/chart 'A' (05 marks)
2. Identify & comment on spotters B to E (Life cycle/Devices used in rearing sericulture) (4x5=20 marks)

TOTAL = 25 Marks