Syllabus for
B.Sc. ZOOLOGY (UG)

I & II SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

To implement from the academic year 2021-22

BANGALORE UNIVERSITY

Proceedings of the meeting of BOS (UG) in Zoology

Reference:

1. G.O. ED: 260/USE/2019 (part-1), Bangalore dated 15.09.2021
2. Email from HEC, GOK dated 15.09.2021
3. University order dated 17.09.2021
4. Meeting with Prof. B. Timmegowda, Vice-chairman, HEC, GOK on 28.10.2021

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 to all the members of BOS, for scrutiny and approval.

Several discussions were held on following dates: 17th, 19th, 21st September 2021 and also on 28th October 2021 to reach final consensus on final syllabus.

Agenda: Approval of syllabus for BSc in Zoology theory and Practical and Scheme of examination for I and II semesters of Bangalore University, Bangalore.

Resolution: The proposed syllabus for BSc in Zoology theory and Practical and Scheme of examination for I and II semesters were scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.

Members Participated (online)

1.	Dr. P. Mahaboob Basha, Professor, Dept of Zoology, Bangalore University, Bangalore.	Chairman
2.	Dr. Asiya Nuzhath F.B, Asso. Professor of Zoology, Tumkur University, Tumkur- 572101.	Member
3.	Dr. Vijaya Kumar, Asso. Professor of Zoology, Kuvempu University, Shankaraghatta- 577115.	Member
4.	Dr. Sitavi Yathiender, Asso. Professor of Zoology, Jyoti Nivas College, Bangalore- 560095.	Member
5.	Dr. Abhinandini I. David. Asso. Professor of Zoology, GFGC, Channapattana-562160.	Member
6.	Dr. Bhushanam M, Asso. Professor of Zoology, Maharanis Science College for Women, Bangalore.	Member
7.	Mrs. Anthuvan Grace, Asst. Professor of Zoology Bishop Cotton Women's College, Bengaluru-	Member
8.	Mr. Ramesh PL, Asso. Professor of Zoology, National College, Basavangudi, Bangalore- 560004.	Member
9.	Mr. Dharmendra, Asst. Professor of Zoology, Nalini Raghunath Rao College, Jigani, Bangalore.	Member

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

The members have sent their consent (approval) through their ID mails the same is recorded and exact of the proceedings prepared for dispatch to academic bodies of University for approval and implementation.

Date: 28.10.2021

(MAHABOOB BASHA)

CHAIRMAN BOS (UG)

B. Sc 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 (5^{th} 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 held on 28th October 2021, Only A1 & A2 are followed as core subjects in Zoology for I and II semesters]

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
1 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,
1 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,
1 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 Enhancement 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 Anim 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 Enhancement 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 des. 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)					

I Semester BSc Zoology
Core Course Content

Course Title/Code: **Cytology, Genetics and Infectious Diseases**	Course Credits: **4**
Course Code: **DSCC5Z00T1**	L-T-P per week: 4-0-0
Total Contact Hours**: 56**	Duration of ESA: 3 Hours
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**
Model Syllabus Authors:	

Core Course prerequisite: To study Zoology in undergraduate, student must have studied Biology or equivalent subject in Class 12.

Course Outcomes (COs):

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

1. The structure and function of the cellorganelles.
2. The chromatin structure and its location.
3. The basic principle of life, how a cell divides leading to the growth ofan
4. Organism and also reproduces to form a new organism.
5. How a cell communicates with its neighboring cells?
6. The principles of inheritance, Mendel 's laws and the deviations.
7. How environment plays an important role by interacting with genetic factors.
8. Detect chromosomal aberrations in humans and study of pedigree analysis.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**CC T1**	**CC 2**	**CC 3**	**CC 4**	**CC 5**	**CC 6**	**CC 7**	**CC 8**	**CC 9**	**CC 10**	**CC 11**
I Core competency	X										
II Critical thinking	X										
III Analytical reasoning	X										
IV Research skills	X										
V Team work	X										

Note: Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark =X 'in the intersection cell if a course outcome addresses a particular program outcome.

Semester I- Zoology
Core Course I Content:

Content	**Hours**
Unit	**14**
Chapter 1. Ultra structure and Function of Cell Organelles I in Animal Cell • Plasma membrane: Chemical composition—Fluid mosaic model • Endomembrane system: protein targeting and sorting, transport, endocytosis and exocytosis, types of cell junctions	

Chapter 2. Structure and Function of Cell Organelles II in Animal Cell • Cytoskeleton: microtubules, microfilaments, intermediate filaments • Mitochondria: Structure, oxidative phosphorylation; electron transport system. Endoplasmic reticulum: Structure, and function. • Peroxisome and Ribosome: structure andfunction	
Unit II	**14**
Chapter 3. Nucleus and Chromatin Structure • Structure and function of nucleus in eukaryotes • Chemical structure and base composition of DNA and RNA • Ultra structure of eukaryotic chromosome, Chromatin Organization-Nucleosome model • Types of DNA and RNA	
Chapter 4. Cell cycle, Cell Division and Cell Signaling • Cell division: mitosis and meiosis • Introduction to Cell cycle and its regulation, apoptosis • Signal transduction: intracellular signaling and cell surface receptors, via G-protein linked receptors. • Cell-cell interaction: -autocrine, paracrine and endocrine types.	
Unit III	**14**
Chapter 5. Mendelism and Sex Determination • Basic principles of heredity: Mendel 's laws- monohybrid cross and dihybridcross • Incomplete Dominance • Genetic Sex-Determining Systems, Environmental Sex Determination, • Chromosomal Sex Determination and mechanism in *Drosophila melanogaster.* • Sex-linked characteristics in humans and dosagecompensation.	
Chapter 6. Extensions of Mendelism, Genes and Environment • Extensions of Mendelism: Multiple Alleles, Gene Interaction-inheritance of comb pattern in fowl. • The Interaction Between Sex and Heredity: Sex-Influenced and Sex-Limited Characteristics • Cytoplasmic Inheritance- Kappa particles in Paramecium, Genetic Maternal Effects. • Interaction between Genes and Environment. • Inheritance of Continuous Characteristics.	
Unit IV	**14**
Chapter 7. Human Chromosomes and Patterns of Inheritance • Patterns of inheritance: autosomal dominance, autosomal recessive, X-linked recessive, X-linked dominant. • Chromosomal anomalies: Structural and numerical aberrations with examples. • Human karyotyping and Pedigree analysis.	
Chapter 8. Infectious Diseases • Introduction to human pathogenic organisms- viruses, bacteria, fungi, protozoa and helminths worms. • Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of common parasites: *Trypanosoma, Giardia and Wuchereria.*	

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman (2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13th Edition. Wiley Blackwell (2017).
9. Principles of Genetics by B. D. Singh
10. Cell-Biology by C. B. Pawar, Kalyani Publications
11. Economic Zoology by Shukla and Upadhyaya

Pedagogy: Written Assignment/Presentation/Project / Term Papers/Seminar

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

Zoology Core Lab Course Content

Semester I

Course Title: Cell Biology &Cytogenetics Lab	Course Credits:**2**
Course Code: **DSCC5Z00P1**	L-T-P per week: 0-0-4
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. To use simple and compound microscopes.
2. To prepare stained slides to observe the cellorganelles.
3. To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form neworganisms.
4. The chromosomal aberrations by preparing karyotypes.
5. How chromosomal aberrations are inherited in humans by pedigree analysis in families. The antigen-antibody reaction.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**CC P1**	**CC 2**	**CC 3**	**CC 4**	**CC 5**	**CC 6**	**CC 7**	**CC 8**	**CC 9**	**CC 10**	**CC 11**
I Core competency	X										
II Critical thinking	X										
III Analytical reasoning	X										
IV Research skills	X										
V Team work	X										

Lab Course Content

List of labs to be conducted	56 h rs.
1. Understanding of simple and compound microscopes. 2. To study different cell types such as buccal epithelial cells, striated muscle cells using Methylene blue/any suitable stain (virtual/ slide/slaughtered tissue). 3. To study the different stages of Mitosis in root tip of *Allium cepa*. 4. To study the different stages of Meiosis in grasshopper testis (virtual/ slides). 5. To check the permeability of cells using salt solution of different concentrations. 6. Study of parasites in humans (e.g. Protozoans, Helminthes in compliance with examples being studied in theory) permanent micro slides. 7. To learn the procedures of preparation of temporary slides (fish scale) and permanent slides, with available mounting material (sex comb of Drosophila/ insect mouth parts). 8. Study of life cycles of *Drosophila* sp. (from Cultures or Photographs). 9. Preparation of polytene chromosomes (Chironomus larva or Drosophila larva). 10. Preparation of human karyotype and study the chromosomal structural and numerical aberrations from the pictures provided. (Virtual/optional). 11. To prepare family pedigrees. 12. https://www.vlab.co.in 13. https://zoologysan.blogspot.com 14. www.vlab.iitb.ac.in/vlab 15. www.onlinelabs.in 16. www.powershow.com 17. https://vlab.amrita.eduhttps://sites.dartmouth.edu/	

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman (2007).
6. Kesar, Saroj and Vasishta N.2007 Experimental Physiology: Comprehensive Manual. Heritage Publishers, NewDelhi.

Pedagogy: Written Assignment/Presentation/Project / Term Papers/Seminar

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	05
Written Assignment/Presentation/Project /Term papers/Seminar	05
Records	05
Viva	05
Class performance/Participation	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 dairyanimals-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 controlmeasures **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 ofprawn. **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). MulberrySilk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia ofBeekeeping, 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.1 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: **3** Hrs.
Formative Assessment Marks: 25	Summative Assessment Marks: **25**
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	05
Attendance and Assignments	05
Visit to Vermicompost unit and report	05
Record/report	05
Viva	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	4	150	4	2
		Open elective	42	3	-	60	22	40	-	-	-	3	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	-	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**

BLUEPRINT FOR PREPARATION OF QUESTION PAPER ZOOLOGY
Paper: Cytology, Genetics and Infectious Diseases
Course Code: DSCC5Z00T1

Unit	Teaching (hrs)	Number of questions				Total marks
		05 (1 mark)	07 (3 marks)	06 (5 marks)	04 (10 marks)	
I	14	1	3	1	1	25
II	14	1	1	2	1	24
III	14	2	2	1	1	23
IV	14	1	1	2	1	24
Total	56	1x5=5	3x7=21	5x6=30	10x4=40	96

Model Question: I Semester B.Sc. Degree examination
ZOOLOGY
Paper: Cytology, Genetics and Infectious Diseases
Course Code: DSCC5Z00T1

Time: 3 Hrs **Maximum Marks: 60**

Instructions to Candidates:

1. Draw neat labelled diagrams wherever necessary.
2. Answer should be completely in English.

PART- A

I. Answer the following in one word or one sentence (5x1=5)

1. _____is the protein present in microfilament of cell.
2. The nitrogenous base Uracil is found in DNA. True/False?
3. Write the phenotypic ratio of Mendel's dihybrid cross?
4. Beard in males is an example of a _____trait.
5. Name the causative agent of giardiasis.

PART- B

I. Answer any **five** of the following: (5x3=15)

1. Mention the cytoskeletal structures present in an animal cell.
2. List any three functions of endoplasmic reticulum.
3. Describe the structure of the peroxisome.
4. What are the types of RNA present in a cell?
5. What is Lygaeus type of sex determination?
6. Write the genotype of A, B and AB blood groups.
7. What is X linked inheritance? Give an example.

PART- C

II. Answer any **four** of the following (4x5=20)

1. Describe the function of the mitochondrion.
2. Explain stages of Zygotene and Pachytene of Prophase I of meiosis.
3. Write short notes on cell surface receptors.
4. Elucidate cytoplasmic inheritance with reference to kappa particles in *Paramecium*.
5. With an example explain autosomal recessive pattern of inheritance.
6. Give the occurrence, disease caused, mode of transmission and preventive measures of *Wuchereria bancrofti*.

PART- D

III. Answer any **two** of the following (2x10=20)

1. With a neat labelled diagram describe the fluid mosaic model of the plasma membrane.
2. a. Describe the structure of the eukaryotic nucleus.
   b. Draw and label the cell cycle.
3. With reference to inheritance of Comb shape in poultry fowls, work out the following crosses:
   a) Homozygous rose comb is crossed with single comb
   b) Homozygous pea comb is crossed with single comb
   c) Conduct a cross between F_1 of a & b, find the offspring.
4. With suitable diagrams explain the life cycle of *Trypanosoma*.

Scheme of Practical Examination
I Semester BSc. Zoology
Cytology, Genetics and Infectious diseases
Course Code: DSCC5Z00P1

Duration: 4 hours **Max. Marks: 25**

1. Prepare a temporary squash of the given material. Identify & comment on stage observed. (For mitosis or meiosis) (08 M)

   OR

   Stain, identify and comment on the given cells/tissue (epithelial/buccal cells)
2. Prepare a whole mount of the given material (Fish scale/Mouthparts of insect) (05 M)
3. Mount and stain the Polytene chromosome/sex comb of *Drosophila*. Comment. (07 M)
4. Identify and comment on the given spotters A and B (2.5 X 2= 05 M)
   Infectious pathogens/ Identify the given karyotype and comment / Pedigree analysis (any two as A and B).

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

B.Sc. SEMESTER I &II
Model Question Paper
Zoology Open Elective (OE)

Time: 3 Hrs **Maximum Marks: 60**

Instructions to Candidates:

1. All sections/parts are compulsory.
2. Draw neat labelled diagrams wherever necessary.

PART- A

I. Answer any **five** of the following (5x2=10)

1. .
2. .
3. .
4. .
5. .
6. .
7. .

PART- B

II. Answer any **five** of the following (5x4=20)

1. .
2. .
3. .
4. .
5. .
6. .

PART- C

III. Answer any **three** of the following (3x10=30)

1. .
2. .
3. .
4. .

Syllabus for
B.Sc. ZOOLOGY (UG)

I & II SEMESTERS

Framed According to the National Educational Policy (NEP 2020)

To implement from the academic year 2021-22

BANGALORE UNIVERSITY

Proceedings of the meeting of BOS (UG) in Zoology

Reference:

1. G.O. ED: 260/USE/2019 (part-1), Bangalore dated 15.09.2021
2. Email from HEC, GOK dated 15.09.2021
3. University order dated 17.09.2021
4. Meeting with Prof. B. Timmegowda, Vice-chairman, HEC, GOK on 28.10.2021

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 to all the members of BOS, for scrutiny and approval.

Several discussions were held on following dates: 17th, 19th, 21st September 2021 and also on 28th October 2021 to reach final consensus on final syllabus.

Agenda: Approval of syllabus for BSc in Zoology theory and Practical and Scheme of examination for I and II semesters of Bangalore University, Bangalore.

Resolution: The proposed syllabus for BSc in Zoology theory and Practical and Scheme of examination for I and II semesters were scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.

Members Participated (online)

1.	Dr. P. Mahaboob Basha, Professor, Dept of Zoology, Bangalore University, Bangalore.	Chairman
2.	Dr. Asiya Nuzhath F.B, Asso. Professor of Zoology, Tumkur University, Tumkur- 572101.	Member
3.	Dr. Vijaya Kumar, Asso. Professor of Zoology, Kuvempu University, Shankaraghatta- 577115.	Member
4.	Dr. Sitavi Yathiender, Asso. Professor of Zoology, Jyoti Nivas College, Bangalore- 560095.	Member
5.	Dr. Abhinandini I. David. Asso. Professor of Zoology, GFGC, Channapattana-562160.	Member
6.	Dr. Bhushanam M, Asso. Professor of Zoology, Maharanis Science College for Women, Bangalore.	Member
7.	Mrs. Anthuvan Grace, Asst. Professor of Zoology Bishop Cotton Women's College, Bengaluru-	Member
8.	Mr. Ramesh PL, Asso. Professor of Zoology, National College, Basavangudi, Bangalore- 560004.	Member
9.	Mr. Dharmendra, Asst. Professor of Zoology, Nalini Raghunath Rao College, Jigani, Bangalore.	Member

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

The members have sent their consent (approval) through their ID mails the same is recorded and exact of the proceedings prepared for dispatch to academic bodies of University for approval and implementation.

Date: 28.10.2021

(MAHABOOB BASHA)

CHAIRMAN BOS (UG)

B. Sc 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 (5^{th} 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 held on 28th October 2021, Only A1 & A2 are followed as core subjects in Zoology for I and II semesters]

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
1 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,
1 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,
1 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 Enhancement 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 Anim 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 Enhancement 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 des. 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 II- Zoology
Core Course Content:

Course Title: **Biochemistry and Physiology**	Course Credits: **4**
Course Code: **DSCC5Z00T2**	L-T-P per week: **4-0-0**
Total Contact Hours**: 56**	Duration of ESA: **3 Hours**
Formative Assessment Marks: **40**	Summative AssessmentMarks:**60**
Model Syllabus Authors:	

Course outcomes:

The student at the completion of the course will learn:

1. To develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrates.
2. How simple molecules together form complex macromolecules.
3. To understand the thermodynamics of enzyme catalyzed reactions.
4. Mechanisms of energy production at cellular and molecular levels.
5. To understand various functional components of an organism.
6. To explore the complex network of these functional components.
7. To comprehend the regulatory mechanisms for maintenance of function in the body.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**CC 1**	**CC T2**	**CC 3**	**CC 4**	**CC 5**	**CC 6**	**CC 7**	**CC 8**	**CC 9**	**CC 10**	**CC 11**
I Core competency		X									
II Critical thinking		X									
III Analytical reasoning		X									
IV Research skills		X									
V Team work		X									

Note: Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark =X 'in the intersection cell if a course outcome addresses a particular program outcome.

Core Course content:

Content	Hours
Unit I	**14**
Chapter 1. Structure and Function of Biomolecules: • Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates). • Lipids (saturated and unsaturated Fatty acids, Tri-acyl glycerols, Phospho lipids, Glycolipids and Steroids) • Structure, Classification and General Properties of a-amino acids; Essential and non-essential amino acids, Levels of organization in proteins; Simple and conjugate proteins.	
Chapter 2. Enzyme Action and Regulation • Nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action. • Isozymes; Mechanism of enzyme action. Clinical use of Isozymes. • Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Equation of Michaelis-Menten, Concept of Km and V max, Enzyme inhibition. • Allosteric enzymes and their kinetics; Regulation of enzyme action.	
Unit 2	**14**
Chapter 3. Metabolism of Carbohydrates and Lipids • Metabolism of Carbohydrates: glycolysis, citric acid cycle, gluconeogenesis, phosphate pentose pathway Glycogenolysis and Glycogenesis Lipids- Biosynthesis of palmitic acid; Ketogenesis, • β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon-atoms	
Chapter 4. Metabolism of Proteins and Nucleotides • Catabolism of amino acids: Transamination, Deamination, Urea cycle, Nucleotides and vitamins • Peptide linkages	
Unit 3	**14**

Chapter 5. Digestion and Respiration in humans • Structural organization and functions of gastrointestinal tract and associated glands. • Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Physiology of trachea and Lung. • Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it; • Control of respiration.	
Chapter 6. Circulation and Excretion in humans • Components of blood and their functions; haemopoesis • Blood clotting: Blood clotting system, Blood groups: Rh-factor, ABO and MN • Structure of mammalian heart • Cardiac cycle; Cardiac output and its regulation, Electrocardiogram, Blood pressure and its regulation • Structure of kidney and its functional unit; Mechanism of urine formation	
Unit IV	**14**
Chapter 7. Nervous System and Endocrinology in humans • Structure of neuron, resting membrane potential(RMP) • Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Types of synapse • Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal; hormones secreted by them. • Classification of hormones; Mechanism of Hormone action.	
Chapter 8. Muscular System in humans • Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus	

Suggested Readings:

I. Nelson & Cox: Leininger ‘s Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet & Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper ‘s Illustrated Biochemistry: McGraw Hill (2003).
5. Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
6. Guyton, A.C & Hall, J.E. Textbook of Medical Physiology, Xl Ed. W.B.Saunders Co. (2006).
7. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Ed. John Wiley & sons (2006).
8. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Ed. Pearson Education (2016).
9. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
10. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (20 I6).

Pedagogy: Written Assignment/Presentation/Project / Term Papers/Seminar

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

Zoology Semester II Core Course Lab Content

Course Title/Code: **Biochemistry and Physiology**	Course Credits: **2**
Course Code: **DSCC5Z00P2**	L-T-P per week: 0-0-4
Total Contact Hours**: 56**	Duration of ESA: **4** Hours
Formative Assessment Marks: **25**	Summative AssessmentMarks:**25**
Model Syllabus Authors:	

Course Outcomes (COs):

At the end of the course the student should be able to
understand: Basic structure of biomolecules through model making.
Develop the skills to identify different types of blood cells.
Enhance basic laboratory skill like keen observation, analysis and discussion. Learn the functional attributes of biomolecules in animal body

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**CC P1**	**CC P2**	**CC 3**	**CC 4**	**CC 5**	**CC 6**	**CC 7**	**CC 8**	**CC 9**	**CC 10**	**CC 11**
I Core competency		X									
II Critical thinking		X									
III Analytical reasoning		X									
IV Research skills		X									
V Team work		X									

Note: Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark =X'in the intersection cell if a course outcome addresses a particular program outcome.

Course Content

List of labs to be conducted	**Hours**
1. Preparation of models of nitrogenous bases- nucleosides and nucleotides. 2. Preparation of models of amino acids and dipeptides. 3. Preparation of models of DNA and RNA. 4. Qualitative analysis of Carbohydrates, Proteins and Lipids. 5. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid. 6. Separation of amino acids or proteins by paper chromatography.	20

7. Determination of the activity of enzyme (Urease)-Effect of [S] and determinationof Km and Vmax. 8. Determination of the activity of enzyme (Urease) - Effect of temperature andtime. 9. Action of salivary amylase under optimum conditions. 10. Quantitative estimation of Oxygen consumption by fresh water Crab. 11. Quantitative estimation of salt gain and salt loss by fresh water.	15
12. Estimation of Hemoglobin in human blood using Sahli's haemoglobino meter.	15
13. Counting of RBC in blood usingHemocytometer. 14. Counting of WBC in blood usingHemocytometer. 15. Differential staining of human blood corpuscles using Leishman stain. 16. Recording of blood glucose level by using glucometer.	
Virtual Labs (Suggestive sites) https://www.vlab.co.in https://zoologysan.blogspot.com www.vlab.iitb.ac.in/vlab www.onlinelabs.inwww.powershow.com https://vlab.amrita.edu https://sites.dartmouth.edu	06

Text Books

1. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan(2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper 's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, Xl Ed., W.B.Saunders Company. (2006).
6. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (2016).

Web References:

- Mammalian Physiology– www.biopac.com

TOPICS RECOMMENDED FOR SEMINAR/PROJECT REPORT

1. Biochemical pathways, their evolutionary background and regulation.
2. Blood groups and their importance.
3. Vital enzymes for human body.
4. Essential and nonessential amino acids.
5. Important body lipids.
6. Significance of animal proteins.
7. Role of carbohydrates in animal body.
8. Role of lipids in structural and functional organization of body.
9. Nature of proteins and nurture of animal body.

Pedagogy: Lectures, Presentations, videos, Virtual Labs, Assignments, Tests, Individual or group Field oriented Project Report on or visit to a research institute.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/Monograph	05
Test	05
Record	05
Viva	05
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 measuresof • *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 *Giardia 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. McGrawHill 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 experiments 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	05
Attendance and Assignments	05
Visit to Mulberry Farm and Sericulture center.	05
Report/ Record	05
Viva	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
2	II	**CORE subject**	56	4	4	60	22	40	25	9	25	3	4	150	4	2
		Open elective	42	3	-	60	22	40	-	-	-	3	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	-	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**

BLUEPRINT FOR PREPARATION OF QUESTION PAPER ZOOLOGY
Paper: Cytology, Genetics and Infectious Diseases
Course Code: DSCC5Z00T1

Unit	Teaching (hrs)	Number of questions				Total marks
		05 (1 mark)	07 (3 marks)	06 (5 marks)	04 (10 marks)	
I	14	1	3	1	1	25
II	14	1	1	2	1	24
III	14	2	2	1	1	23
IV	14	1	1	2	1	24
Total	56	1x5=5	3x7=21	5x6=30	10x4=40	96

BANGALORE UNIVERSITY
ZOOLOGY B. Sc (UG) (CBCS)
BLUEPRINT FOR PREPARATION OF QUESTION PAPER II
Biochemistry and Physiology
Course Code: DSCC5Z00T2

Unit	Teaching (hrs)	Number of questions				Total marks
		05 (1 mark)	07 (3 marks)	06 (5 marks)	04 (10 marks)	
I	14	1	3	1	1	25
II	14	1	1	2	1	24
III	14	2	2	1	1	23
IV	14	1	1	2	1	24
Total	56	1x5=5	3x7=21	5x6=30	10x4=40	96

Model Question Paper
II Semester B.Sc. Degree examination
ZOOLOGY
Biochemistry and Physiology
Course Code: DSCC5Z00T2

Time: 3 Hrs **Maximum Marks: 60**

Instructions to Candidates:

1. Draw neat labelled diagrams wherever necessary.
2. Answer should be completely in English.

PART- A

I. Answer the following in **one word or one sentence** (5x1=5)

1. _____is an example for ketotriose sugar.
2. The component found in all sphingolipid is an amino alcohol. True/False?
3. Name the common compound shared by TCA cycle and Urea cycle
4. In the striated muscles, the functional unit of contractile system is _____
5. Name the non-digestive enzyme found in intestinal juice.

PART- B

II. Answer any **five** of the following: (5x3=15)

1. List the biological functions of proteins.
2. Mention any three clinical use of Isoenzymes.
3. What is the role of HCl in digestion?
4. Differentiate between saturated and unsaturated fatty acids
5. What is ultra-filtration?
5. What are the factors involved in blood coagulation?
6. Explain Haldane effect?
7. Draw a neat labeled diagram of ultra-structure of skeletal muscle.

PART- C

III. Answer any **four** of the following (4x5=20)

1. What are enzymes? Discuss the chemical nature and properties of enzymes.
2. Give an account of digestion of proteins in humans.
3. Write short notes on the following: a) Resting membrane potential. b) Gluconeogenesis.
4. Discuss the origin and conduction of heart beat in human.
5. List out the functions of thyroid gland.
6. Explain the chemical basis of muscle contraction.

PART- D

IV. Answer any **two** of the following (2x10=20)

1. Write a note on: a) Biosynthesis of palmitic acid b) Electrocardiogram
2. Explain the physiology of urine formation
3. Explain the transport of gases in humans
4. Classify hormones based on chemical nature with example and write a note on mechanism of hormone action.

Scheme of Practical Examination
II Semester BSc. Zoology
Biochemistry and Physiology
Course Code: DSCC5Z00P2

Duration: 4 hours Max. Marks: 25

1. Physiology/Biochemistry Experiment I (Nos 1-6 from syllabus)	(10 marks)
2. Physiology/Biochemistry Experiment II (Nos 7-11 from syllabus)	(10 marks)
3. Physiology/Biochemistry Experiment III (Nos 12-16 from syllabus)	(05 marks)
	25 marks

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

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

1. Identify & describe the system of the given specimen/chart 'A'	(08 marks)
2. Identify & comment on spotters B to D (Life cycle/Devices used in sericulture/ Disease causing agents or pests)	(3x4=12 marks)
3. Submission of Project report	(05 marks)
TOTAL	**= 25 Marks**

B.Sc. SEMESTER I &II
Model Question Paper
Zoology Open Elective (OE)

Time: 3 Hrs **Maximum Marks: 60**

Instructions to Candidates:

1. All sections/parts are compulsory.
2. Draw neat labelled diagrams wherever necessary.

PART- A

I. Answer any **five** of the following (5x2=10)

1. .
2. .
3. .
4. .
5. .
6. .
7. .

PART- B

II. Answer any **five** of the following (5x4=20)

1. .
2. .
3. .
4. .
5. .
6. .

PART- C

III. Answer any **three** of the following (3x10=30)

1. .
2. .
3. .
4. .

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course- as per NEP 2020)

Syllabus for Zoology
(III & IV Semester)

2022-23 onwards

BENGALURU CITY UNIVERSITY

Proceedings of the meeting of BOS (UG) in Zoology.

Reference:

1. G.O. ED: 260/USE/2019(part-1), Bangalore dated 15.09.2021
2. Email from HEC, GOK dated 15.09.2021
3. U.O No: BCU/Syn/BOS/Syllabus/157/2022-23 dtd. 17.08.2022.

Adverting to above, the draft of the syllabus prepared by the faculty of Bangalore University with support of Curriculum design/ Syllabus framing Committee set by Higher Educational Council (HEC), Government of Karnataka (GOK) pertaining to NEP. The syllabus of B. Sc Zoology was circulated well in advance by online mode to all the members of BOS, for scrutiny.

A meeting of the BOS (UG) in Zoology was held at Dept. of Life Science, Central College on Friday, the 26th August 2022 during 10.00 to 4.00 pm to reach the final consensus on the given agenda.

Agenda: Approval of syllabus for BSc in Zoology theory and Practical and Scheme of examination for III and IV semesters of Bangalore University, Bangalore.

Resolution:

1. The proposed syllabus for BSc in Zoology theory and Practical and Scheme of examination for III and IV semesters were scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.
2. The panel of Examiners (Both internal and external) for B.Sc. in Zoology (UG) for the year 2022-23 was approved.

Members Participated

1.	Dr. P. Mahaboob Basha, Prof. of Zoology & Chairman, Dept of Zoology, BUB	Chairman
2.	Dr. [illegible] Associate Professor in Zoology, Maharani Cluster University, Bangalore.	Member
3.	Mr. Chandrappa, Associate Professor in Zoology, GFGC, Yelahanka, Bangalore.	Member
4.	Dr. Hemalatha A, Asso. Professor in Zoology, Maharani Cluster University, B'lore	Member – ABSENT
5.	Dr. Srivatsa S, Associate Professor in Zoology, Vijaya College, Bangalore.	Member – ABSENT
6.	Dr. Ganesh U, Associate Professor in Zoology, MES College, Bangalore.	Member
7.	Dr. Shubha M, Associate Professor in Zoology, BMS College, Bangalore.	Member
8.	Ms. Dhanalakshmi, Associate Professor in Zoology, Vijaya College, Bangalore	Member.
9.	Dr. Ashok CH, Associate Professor in Zoology, Nrupathunga University, Bangalore.	Member
10.	Dr. CE Triveni Associate Professor in Zoology, VV Puram College, Bangalore.	Member

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

Date: 26.08.2022

(P. MAHABOOB BASHA)
CHAIRMAN BOS (UG)
B. Sc in Zoology

F O R E W O R D

National Education Policy (NEP) 2020 seeks to transform the Higher Education system in India by introducing the exit and entry option to the students. Selecting courses of choice will improve the education quality of the students. A creative combination of disciplines like Core, Open Elective, and Elective courses with multi-disciplinary nature is one key recommendation of NEP 2020.

The multiple exit and entry options in the Higher Education System would remove rigid boundaries and create new possibilities for students to choose and learn the courses of their choice anywhere in India can pave the wave for improving student progress. A formal system of credit recognition, credit accumulation, credit transfers and credit redemption is a praiseworthy recommendation in the education system. Karnataka is the first state in the country to implement NEP in higher education. The state come up with the NEP framework for all the UG-PG programmes starting from the academic year 2021.

The prominent features of the NEP framework are:

1. Flexibility in choosing subjects and even disciplines for the graduate programmes.
2. Vertical and horizontal mobility across subjects throughout the programme.
3. Multiple entry and exit points.
4. Main streaming of skill based courses.
5. Credit based evaluation system.
6. Integration of research into IV year of the programme leading to Honors degree.
7. Post-graduate Diplomas in respective disciplines.

I am delighted to present curriculum structure and syllabus of B. Sc Degree in Zoology with multiple exist entry with skills and job opportunities in point of exit system. I hope that the curriculum structure and syllabus will pave the way for overall development of the student community. I ensure that, students community will procure the benefits at large in higher education

Dr. P Mahaboob Basha
Chairman
BOS (UG) in Zoology
Bengaluru City University

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 (I & II sem)**
2022-23 (III &IV sem)

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 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.

AIMS AND OBJECTIVES OF UG PROGRAM IN ZOOLOGY

- The Program 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 Structure of the Under-Graduate Program(s) 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) (One Core to be chosen)	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)								

*BOS resolved to adopt only B1 and B2 core subjects for the year 2021-22

SEMESTER WISE CURRICULUM STRUCTURE OF COURSES

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
1 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 humans by pedigree analysis in families.	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 Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of pedagogy,
1 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,
1 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 Assessment	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/ Summative 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 Enhancement 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 Animal 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 Conservation (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,
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 Enhancement 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		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 (In Place of		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)						

III Semester BSc Zoology
Core Course Content

Course Title/Code: **Molecular Biology, Bioinstrumentation & Techniques in Biology**	Course Credits: **4**
Course Code: **DSCC5ZOOT3**	L-T-P per week: 4-0-0
Total Contact Hours**: 56**	Duration of ESA: 3 Hours
Formative Assessment Marks: 4**0**	Summative Assessment Marks:**60**
Model Syllabus Authors:	

Course Outcomes (COs):

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

1. After successful accomplishment of the course, the learners will be able to acquire better understanding and comprehensive knowledge regarding most of the essential aspects of Molecular Biology subject which in turn will provide a fantastic opportunity to develop professional skill related to the field of molecular biology.
2. The course will mainly focus on the study of principal molecular events of cell incorporating DNA Replication, Transcription and Translation in prokaryotic as well as eukaryotic organisms.
3. Acquiring knowledge on instrumentation and techniques in biology.

Semester III- Zoology
Core Course III Content:

Content	Hours
Unit I	**14**
Chapter 1: Process of Transcription • Fine structure of gene (Cistron, Recon, Muton) • RNA polymerases - types and functions • Transcription in prokaryotes and eukaryotes	8
Chapter 2: Process of Translation • Genetic code and its salient features • Translation in prokaryotes and eukaryotes	6
Unit II	**14**
Chapter 3. Regulation of Gene Expression-I • Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon (repressible) in *E. coli* • Regulation of gene expression in eukaryotes - Role of chromatin (Euchromatin and Heterochromatin) in gene expression • Post-transcriptional modification: capping, splicing, polyadenylation • Concept of RNA editing (mRNA), gene silencing, and, RNAi •	9
Chapter 4. Regulation of Gene Expression-II • Post-translational modifications: purpose, advantages, and significance; glycosylation, methylation, phosphorylation, and acetylation. • Intracellular protein degradation (lysosomal autophagy and ubiquitin proteasome pathway).	5

Unit III	14
Chapter 5: Microscopy • Principles and applications of Light microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM).	9
Chapter 6: Centrifugation and Chromatography • Principle of centrifugation. • Types of centrifuges: High speed and Ultracentrifugation. • Principle and applications of Chromatography: TLC and HPLC.	5
Unit IV	**14**
Chapter 7: Biochemical Instrumentation • Colorimetry and Spectrophotometry: Beer-Lambert's law, Absorption spectrum, UV-VL Spectrophotometer. • pH meter, measurement of pH • Principle, applications and safety measures of Radio-tracer techniques - Autoradiography.	6
Chapter 8: Molecular Techniques • Principle and applications of Agarose gel-electrophoresis, SDS-PAGE, DNA Sequencing (Sanger's method) • PCR, DNA Fingerprinting, ELISA, Southern Blotting and Western Blotting.	8

Suggested Readings:

Pedagogy: Written Assignment/Presentation/Project / Term Papers/Seminar

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
House Examination/Test	15
Written Assignment/Presentation/Project / Term	15
Class performance/Participation	10
Total	**40**

Zoology

Core Course Lab Content

Semester III (Practical III)

Course Title: **Molecular Biology, Bioinstrumentation and Techniques in Biology**	Course Credits: **2**
Course Code: DSCC5ZOOP3	L-T-P per week: 0-0-4
Total Contact Hours**: 56**	Duration of ESA: 3 Hours
Formative Assessment Marks: **25**	Summative Assessment Marks:**25**

Course Outcomes (COs):

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

1. At the end of the course, students will be able to understand the applications of biophysics and principle involved in bio-instruments.
2. Understand the methodology involved in bio techniques.
3. Students can Demonstrate knowledge and practical skills of using instruments in biology and medical field.
4. They can perform techniques involved in molecular biology and diagnosis of diseases.

Lab Course Content

List of experiments	14 units (1unit- 4hrs)
1. To study the principle and applications of simple, compound and binocular microscopes.	1
2. To study the principle and applications of various lab equipments- pH meter, Electronic balance, Vortex mixer, use of glass and micropipettes, Laminar air flow, Incubator, shaker, Water bath and centrifuge.	2
3. To prepare Buffer solutions (Phosphate, Citrate, Tris-HCl buffer)	1
4. To estimate amount of RNA by Orcinol method.	2
5. Demonstration of differential centrifugation to fractionate components in a given mixture.	1
6. To estimate amount of protein by Lowry's method.	2
7. To identify different unknown amino acids using ascending paper chromatography.	1
8. Extraction of DNA from the given animal tissue sample.	2
9. To estimate amount of DNA by di-phenyl amine (DPA) method.	2

Suggested Readings:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell, 4th edition. New York: Garland Science (2002).
2. Daniel L. Hartl and Maryellen Ruvolo. Genetics: Analysis of Genes and Genomes, 8th Edition. Burlington, Mass.: Jones & Bartlett Learning (2012).
3. Gerald Karp. Cell and Molecular Biology: Concepts and Experiments, 5th Edition. Wiley Publication (2008).
4. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Freeman. Molecular Cell Biology, 5th edition. W. H. & Company (2003).
5. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. Molecular Biology of the Gene, 5th edition. Cold Spring Harbor Laboratory Press (2003).
6. Stryer, Lubert. Biochemistry, 2nd Edition. W. H. Freeman and Company, New York (1981).

Pedagogy: Written Assignment/Presentation/Project / Term Papers/Seminar

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	05
Written Assignment/Presentation/Project /Term papers/Seminar	10
Class performance/Participation	10
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	21	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	21	40	-	-	-	2.5	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	3	3	50	-	2
2	II	**CORE subject**	56	4	4	60	21	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	21	40	-	-	-	2.5	-	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**

Practicals:

Sl. No.	Particulars	IA Marks
1	Practical Test	10
2	Report / Seminar on practical experiments, etc.	10
3	Active participation in practical classes (Attendance)	05
	TOTAL Theory IA Marks	**25**

Scheme of Practical Examination
BSc. Zoology III Semester
Core Subject: Molecular Biology, Bioinstrumentation and Techniques in Biology

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

1. Extraction of DNA from the given animal tissue
   OR
   Estimation of DNA / RNA / Proteins 10M

2. Separate and Identify the given unknown amino acids by using ascending paper Chromatography 07M
3. Identify and give the working principle of the spotters A and B 4X2-8M

TOTAL Marks 25M

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Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

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Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course- as per NEP 2020)

Syllabus for Zoology
(III & IV Semester)

2022-23 onwards

BENGALURU CITY UNIVERSITY

Proceedings of the meeting of BOS (UG) in Zoology.

Reference:

1. G.O. ED: 260/USE/2019(part-1), Bangalore dated 15.09.2021
2. Email from HEC, GOK dated 15.09.2021
3. U.O No: BCU/Syn/BOS/Syllabus/157/2022-23 dtd. 17.08.2022.

Adverting to above, the draft of the syllabus prepared by the faculty of Bangalore University with support of Curriculum design/ Syllabus framing Committee set by Higher Educational Council (HEC), Government of Karnataka (GOK) pertaining to NEP. The syllabus of B. Sc Zoology was circulated well in advance by online mode to all the members of BOS, for scrutiny.

A meeting of the BOS (UG) in Zoology was held at Dept. of Life Science, Central College on Friday, the 26th August 2022 during 10.00 to 4.00 pm to reach the final consensus on the given agenda.

Agenda: Approval of syllabus for BSc in Zoology theory and Practical and Scheme of examination for III and IV semesters of Bangalore University, Bangalore.

Resolution:

1. The proposed syllabus for BSc in Zoology theory and Practical and Scheme of examination for III and IV semesters were scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.
2. The panel of Examiners (Both internal and external) for B.Sc. in Zoology (UG) for the year 2022-23 was approved.

Members Participated

1.	Dr. P. Mahaboob Basha, Prof. of Zoology & Chairman, Dept of Zoology, BUB	Chairman
2.	Dr. [illegible] Associate Professor in Zoology, Maharani Cluster University, Bangalore.	Member
3.	Mr. Chandrappa, Associate Professor in Zoology, GFGC, Yelahanka, Bangalore.	Member
4.	Dr. Hemalatha A, Asso. Professor in Zoology, Maharani Cluster University, B'lore	Member – ABSENT
5.	Dr. Srivatsa S, Associate Professor in Zoology, Vijaya College, Bangalore.	Member – ABSENT
6.	Dr. Ganesh U, Associate Professor in Zoology, MES College, Bangalore.	Member
7.	Dr. Shubha M, Associate Professor in Zoology, BMS College, Bangalore.	Member
8.	Ms. Dhanalakshmi, Associate Professor in Zoology, Vijaya College, Bangalore	Member.
9.	Dr. Ashok CH, Associate Professor in Zoology, Nrupathunga University, Bangalore.	Member
10.	Dr. CE Triveni Associate Professor in Zoology, VV Puram College, Bangalore.	Member

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

Date: 26.08.2022

(P. MAHABOOB BASHA)
CHAIRMAN BOS (UG)
B. Sc in Zoology

F O R E W O R D

National Education Policy (NEP) 2020 seeks to transform the Higher Education system in India by introducing the exit and entry option to the students. Selecting courses of choice will improve the education quality of the students. A creative combination of disciplines like Core, Open Elective, and Elective courses with multi-disciplinary nature is one key recommendation of NEP 2020.

The multiple exit and entry options in the Higher Education System would remove rigid boundaries and create new possibilities for students to choose and learn the courses of their choice anywhere in India can pave the wave for improving student progress. A formal system of credit recognition, credit accumulation, credit transfers and credit redemption is a praiseworthy recommendation in the education system. Karnataka is the first state in the country to implement NEP in higher education. The state come up with the NEP framework for all the UG-PG programmes starting from the academic year 2021.

The prominent features of the NEP framework are:

1. Flexibility in choosing subjects and even disciplines for the graduate programmes.
2. Vertical and horizontal mobility across subjects throughout the programme.
3. Multiple entry and exit points.
4. Main streaming of skill based courses.
5. Credit based evaluation system.
6. Integration of research into IV year of the programme leading to Honors degree.
7. Post-graduate Diplomas in respective disciplines.

I am delighted to present curriculum structure and syllabus of B. Sc Degree in Zoology with multiple exist entry with skills and job opportunities in point of exit system. I hope that the curriculum structure and syllabus will pave the way for overall development of the student community. I ensure that, students community will procure the benefits at large in higher education

Dr. P Mahaboob Basha
Chairman
BOS (UG) in Zoology
Bengaluru City University

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 (I & II sem)**
2022-23 (III &IV sem)

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 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.

AIMS AND OBJECTIVES OF UG PROGRAM IN ZOOLOGY

- The Program 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 Structure of the Under-Graduate Program(s) 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) (One Core to be chosen)	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)								

*BOS resolved to adopt only B1 and B2 core subjects for the year 2021-22

SEMESTER WISE CURRICULUM STRUCTURE OF COURSES

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
1 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 humans by pedigree analysis in families.	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 Assessment	Formative and Summative Assessment/ Evaluation/ Analysis of result/ Application of pedagogy,
1 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,
1 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 Assessment	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/ Summative 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 Enhancement 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 Animal 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 Conservation (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,
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 Enhancement 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		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 (In Place of		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 IV- Zoology Core Course IV Content:

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

Course Title: **Core Course Content: Gene Technology Immunology and Computational Biology**	Course Code: **DSCC5ZOOT4**
Course Type: **Discipline Core Theory, L-T-P: 4-0-0**	Course Credits: **4**
Total Contact Hours: **56**	Duration of ESA: **3 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. Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA technology.
2. An understanding on application of genetic engineering techniques in basic and applied experimental biology.
3. To acquire a fundamental working knowledge of the basic principles of immunology.
4. To understand how these principles, apply to the process of immune function.
5. Use, and interpret results of, the principal methods of statistical inference and design; helps to communicate the results of statistical analyses accurately and effectively; helps in usage of appropriate tool of statistical software.

Course Content	Hrs.
Unit I	**14**
Chapter 1: Principles of Gene Manipulation ● Recombinant DNA Technology: Introduction, steps involved. ● Restriction Enzymes and Ligases. Nucleic acid modifying enzymes. ● Gene cloning Vector: Concept of plasmids-pBR322, Lambda phage vectors, Cosmids. ● Gene transfer techniques (Direct and indirect). ● Screening and selection of recombinant colonies.	07
Chapter 2: Applications of Genetic Engineering • Transgenic animals (Transgenic cow, Transgenic Fish); Transgenic plants (cry protein); Gene silencing (Knock out mouse). ● Production of Human Recombinant insulin and Monoclonal antibodies (Hybridoma technology). ● Applications of Gene Therapy in SCID ● Brief account of Biosensors.	07
Unit II	**14**

Chapter 3: Introduction to the Immune System • Defence against diseases: Introduction, First and second line of defence, Innate and acquired immunity; Antigen presenting cells (APC's), Role of B and T-lymphocytes (Humoral immunity and cell mediated immunity), primary and secondary immune response. Types of immunity. • Functional aspects of organs of the Immune system - Thymus and bone marrow, spleen, Lymph Node, Small intestine and Liver (Peyer's patches and Von Kupffer cells).	07
Chapter 4: Antigens and Antibodies • Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). • B and T cell epitopes. • Structure of IgG and functions of different classes of immunoglobulins. • Major histocompatibility complex - Structure of MHC I & II.	07
Unit III	**14**
Chapter 5: Clinical Immunology • Immunity against diseases of viral, bacterial and protozoan infections. • Vaccines: Types and Uses - Immunization schedule for children. • Transplantation immunology: Transplantation of organ- Types, graft rejection and Immuno-suppressors.	07
Chapter 6: Bioinformatics • Databases: Sequence and structural • Sequence analysis (homology): Pairwise and Multiple Sequence alignment- BLAST, CLUSTALW, Sequence alignment- FASTA. • Scope and applications of Bioinformatics.	07
Unit IV	**14**
Chapter 7: Biostatistics I • Measures of central tendency: Mean, Median, Mode. • Data summarizing: Frequency distribution, Graphical presentation - bar diagram, pie diagram, histogram. • Elementary idea of probability and its applications.	07
Chapter 8: Biostatistics II • Measures of dispersion: Range, Standard Deviation, Variance. • Correlation and Regression. • Tests of significance: F-test, ANOVA, t-test and Chi square test.	07

Topics Suggested for Assignment/ Formative Assessment:

1. Q/A, Short Question, Quiz, MCQ, Assignment etc.

Recommended Books:

1. Primrose &Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: principles &Analsysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook*et al*. Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. Clark & Switzer. Experimental Biochemistry. Freeman (2000)
6. Sudbery. Human Molecular Genetics. Prentice-Hall (2002).
7. Wilson. Clinical Genetics-A Short Course, Wiley (2000).
8. Pasternak. An Introduction to Molecular Human Genetics. Fritzgerald (2000).
9. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi.

10. Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey Blackwell
11. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
12. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. Meiners
13. Westhead et al Bioinformatics: Instant Notes. Viva Books (2003)

Web Sources:

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: IV

Course Lab Content

Course Title: **Gene Technology, Immunology and Computational Biology**	Course Credits: **02**
Course Type: **Minor Discipline Core Practical, L-T-P: 0-0-4**	Corse Code: DSCC5ZOOP4
Total Contact Hours: **56**	Duration of ESA: 3 **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. Accurately, safely and appropriately use all the equipment regularly used in Molecular Biology (DNA manipulation, including balances, pipettes, electrophoresis and centrifuges).
2. Prepare chemical solution and reagents to the precision appropriate to the task.
3. Demonstrate knowledge of the biochemical basis underpinning the molecular

Lab IV Course Content

List of labs to be conducted	14 units (1unit-4hr.
1. Calculate the mean, median, mode and standard deviation (Measurement of pre and post clitellar lengths of earthworms)	2
2. Measure the height and weight of all students in the class and apply statistical measures.	1
3. Determination of ABO Blood group and Rh factor.	1
4. To study Restriction enzyme digestion using teaching kits (Demonstration only).	2
5. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only).	2
6. Demonstration of agarose gel electrophoresis for detection of DNA.	1
7. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.	2
8. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (https://youtube/mCiCiO0cfbg)	1
9. To learn nucleotide sequence database.	1
10. To learn sequence alignment: Pairwise alignment (Protein/ DNA).	1

Pedagogy: Lectures, Presentations, videos, Labs, Assignments, Tests, Individual or group Field oriented Project Report**.**

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/Monograph	10
Test	10
Participation in class	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	21	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	21	40	-	-	-	2.5	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	3	3	50	-	2
2	II	**CORE subject**	56	4	4	60	21	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	21	40	-	-	-	2.5	-	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**

Practicals:

Sl. No.	Particulars	IA Marks
1	Practical Test	10
2	Report / Seminar on practical experiments, etc.	10
3	Active participation in practical classes (Attendance)	05
	TOTAL Theory IA Marks	**25**

Scheme of Practical Examination
BSc. Zoology IV Semester
Zoology Core Subject: Gene Technology

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

1.	Determine the blood group of the given sample and comment	05M
2.	Problem on Chapter 7	06M
3.	Problem on Chapter 8	06M
4.	Identify and comment on the given spotters A and B (PCR/PAGE/Restriction enzyme kit/FASTA/BLAST/Database)	08M
	TOTAL Marks	25M

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course)

Syllabus for Zoology
(V & VI Semester)

2023-24

Guidelines For Model Curriculum

1. The Universities shall promote Double Major model as prescribed in the Model Curriculum Table.
2. For Arts/Humanities/Social Science - V & VI sem, three core papers (DSC) to be selected in each semester.
   For Science – Ensure two core papers (DSC) should get minimum of 12 credits/or 2 major subjects of 24 credits (4+2 patterns)
   (1 hour of Lecture or 2 hours of practical/field work per week in a semester is assigned one credit and core subject theory courses/papers will have 4 credits, while practical are assigned 2 credits)
3. Formative assessment and summative assessment to be followed in the ratio of 40:60.
4. Selection of Open electives: The university shall follow curriculum and credit frame work for Undergraduate program of published by UGC. **Open Electives – Courses from other Disciplines (9 Credits)**
   - Students are not allowed to choose or repeat courses as open electives already undergone at the higher secondary level (12th class)
   - All UG students are required to undergo 3 introductory-level courses relating to any of the broad disciplines given below.

Natural and Physical Sciences	Mathematics, Statistics, & Computer Applications	Library, Information, and Media Sciences	Commerce and Management	Humanities and Social Sciences:
Students can choose basic courses from disciplines such as Natural Science, for example, Biology, Botany, Zoology, Biotechnology, Biochemistry, Chemistry,	Courses under this category will facilitate the students to use and apply tools and techniques in their major and minor disciplines. The course may include training in programming software like Python among others and applications software	Courses from this category will help the students to understand the recent developments in information and media science (journalism, mass media, and communication)	Courses include business management, accountancy, finance, financial institutions, fintech, etc.,	The courses relating to Social Sciences, for example, Anthropology, Communication and Media, Economics, History, Linguistics, Political Science, Psychology, Social Work, Sociology, etc. will enable students to understand the individuals and their social behavior, society, and nation. Students be introduced to survey methodology and available large-scale databases
Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental Sciences, etc.	like STATA, SPSS, Tally, etc. Basic courses under this category will be helpful for science and social science in data analysis and the application of quantitative tools			for India. The courses under humanities include, for example, Archaeology, History, Comparative Literature, Arts & Creative expressions, Creative Writing and Literature, language(s), Philosophy, etc., and interdisciplinary courses relating to humanities. The list of Courses that can include interdisciplinary subjects such as Cognitive Science, Environmental Science, Gender Studies, Global Environment & Health, International Relations, Political Economy and Development, Sustainable Development, Women's and Gender Studies, etc. will be useful to understand society.

Following is the blue print of the question paper to be followed.

BSc.-Science: Curriculum and Credit Framework for Undergraduate Programme

Sem.	Discipline Specific Courses - Core (DSC), Elective (DSE)(Credits) (L+T+P)	Minor/ Multidisciplinary/ Open Elective (OE) Courses(Credits) (L+T+P)	Ability Enhancement Courses (AEC)(Credits)(L+T+P) (Languages)	Skills Enhancement Courses (SEC) (Credits) (L+T+P)/ Value Added Courses (Credits) (L+T+P) (common for all UG Programs)/ Summer Internship.		Total Credits
I	DSC-A1(4), A2(2) DSC-B1(4), B2(2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs each)	**SEC-1**: Digital Fluency (2) (1+0+2)/ Env. Studies (3)	Health, Wellness & Yoga (2) (1+0+2)	25/26
II	DSC-A3(4), A4(2), DSC-B3(4), B4(2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs each)	Env. Studies (3)/ SEC-1: Digital Fluency (2)(1+0+2)	Sports/NCC/NSS/R&R(S&G) / Cultural (2) (0+0+4)	26/25
Students exiting the programme after securing 46 credits will be awarded UG Certificate in Disciplines A and B provided they secure 4 credits in work based vocational courses during summer term or internship/Apprenticeship in addition to 6 credits from skill-based courses earned during the first year.						
III	DSC-A5(4), A6(2), DSC-B5(4), B6(2)	OE-3 (3)/ India and IndianConstitution (3)	L1-3(3), L2-3(3) (4 hrs. each)	**SEC-2**:AI/Cyber Security/Finan- cial Edu. & Inv. Aw. (2) (1+0+2)	Sports/NCC/NSS/R&R(S&G) /Cultural (2) (0+0+4)/ SEC (2)	25
IV	DSC-A7(4), A8(2), DSC-B7(4), B8(2)	India and Indian Constitution (3) / OE-3(3)	L1-4(3), L2-4(3) (4 hrs. each)	**SEC-3**: Financial Edu. &Inv. Aw. /AI /Cyber Security (2) (1+0+2)	Sports/NCC/NSS/R&R(S&G)/ Cultural (2) (0+0+4)/ SEC (2)	25
Students exiting the programme after securing 92 credits will be awarded UG Diploma in Disciplines A and B provided they secure additional 4 credits in skill based vocational courses offered during first- or second-year summer term.						
V	DSC-A9(4), A10(2), A11(4), A12(2);	DSC-B9(4), B10(2), B11(4), B12(2)		**SEC-4**: Employability Skills/Cyber Security (3) (2+0+2)		27
VI	DSC-A13(4), A14(2), A15(4), A16(2);	DSC-B13(4), B14(2), B15(4), B16(2)		Internship (2)		26
Students exiting the programme after 3-years will be awarded UG Degree in Disciplines A and B as double majors upon securing 136 credits and satisfying the minimum credit requirements under each category of courses prescribed.						

Internship for graduate Programme (As Per UGC & AICTE)

Course title	Internship Discipline specific
No of contact hours	90
No credits	2
Method of evaluation	Presentations/Report submission/Activity etc.,

- Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session)
- Internship mentor/supervisor shall avail work allotment during 6th semester for a maximum of 20 hours.
- The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC and AICTE guidelines.

Following is the blue print of the question paper to be followed.

SUBJECT EXPERT COMMITTEE MEMBERS -KSHEC
(As per BOS resolution dated 20.09.2022)

S. No.	Name and Organization	Designation
1	Prof. K. Vijaykumar, Department of Zoology, Gulbarga University, Kalaburagi. Ph:.9480060508,katepaga63@gmail.com	Chairman
2	Prof. P.M Basha, Department of Zoology, Bangalore University, Bengaluru Ph:.9448701652, pmbashabub@rediffmail.com	Member
3	Prof. Vijaykumar B Malashetty, Department of Zoology, VSK University, Ballari. Ph:.9343011567,vijaymalashetty@gmail.com	Member
4	Prof. S. Basavarajappa, Mysore University, Mysuru. Ph:.9449203241, E-mail: ornithoraj11@gmail.com	Member
5	Prof. Nagaraj, Department of Zoology, Kuvempu University, Shivamogga. Ph:.9620485338	Member
6	Prof. Kareemunnisa Syed, Nrupathunga University, Bengaluru, Ph:.9964300991, kareemunnisa66@gmail.com	Member
7	Prof. B. Vasanthkumar, Department of Zoology, Sir MVGovt. College,Bhadravathi,Shimoga	Member
8	Prof. B.K. Meera, Professor, Maharani Cluster University, Bengaluru Ph:.9886409382.	Member
9	Dr. D. Gangadhara Rao, Professor, Govt. Women's College, Kolar. Ph:.9448984956	Member
10	Prof. Shankarappa S.Hatti, Govt. College, Dept. of Zoology, SedamRoad,Kalaburagi.9980391964	Member
11	Dr. Zeba Parveen Dept. Of Zoology, Bi Bi Raza Women's Degree College, Kalaburagi. Ph:.9448092786	Member
12	Dr. Asiya Nuzhath F.B, Associate Professor, Dept. Of Zoology, Tumkur University, Tumakuru. Ph:.9844029441	Member
13	Ms. Akshatha, Special Officer, KSHEC, Bengaluru. Ph:.9535487108	Member Convener

Following is the blue print of the question paper to be followed.

Bengaluru City University Subject Committee BOS members for Zoology

(As per BOS resolution dated 20.09.2022)

SN	Name& Organization	Designation
1	Dr. P. MAHABOOB BASHA, Prof. of Zoology, Bangalore University, Bangalore-560056.	Chairman
2	Dr. HEMALATHA A. Prof. of Zoology, Maharani Cluster University, Bangalore- 560001.	Member
3	Dr. SHABANA BEGUM. Prof. of Zoology, Maharani Cluster University Bangalore- 560001	Co-opted Member(E)
4	Dr. LATHA, V. Asso. Prof. of Zoology, Maharani Cluster University, Bangalore- 560001	Co-opted Member(E)
5	Mr. CHANDRAPPA, Associate Prof. of Zoology, GFGC, Yelahanka, Bangalore. 9886884996.	Member
6	Mrs. DHANALAKSHMI. N, Asst. Prof of Zoology, Vijaya College, RV Road, Bangalore-560004.	Member
7	Dr. C.E. TRIVENI, V.V. Puram College of Science, K. R. Road, Bangal	Member
8	Dr. SHUBHA M, Assistant Professor in zoology, BMS College for Women, Bengaluru-560004.	Member
9	Dr. BHUSHANAM. Asso. Prof. of Zoology, Maharani Cluster Universit Bangalore- 560001	Co-opted Member(E)

Note:

1. Sl. No 3-4 & 9 were co-opted in the place of Superannuated BOS members.

(P. MAHABOOB BASHA)
Chairman, BOS (UG)Zoology, BCU

Following is the syllabus for V SEMESTER B.Sc., ZOOLOGY Theory Syllabus as per BOS resolution dated 20.09.2022)

V SEMESTER B.Sc., ZOOLOGY THEORY SYLLABUS
DISCIPLINE SPECIFIC CORE COURSE (DSCC)

THEORY PAPER: NON-CHORDATES AND ECONOMIC ZOOLOGY

1. Course Description

Program Name	**B.Sc.,**		Semester	V
Course Title	**Non-Chordates and Economic Zoology (Theory)**			
Course Code:	DSC**C5 ZOO -T5**		No. of Credits	**4**
Contact hours	**60 Hours**		Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**		Summative Assessment Marks	**60**

Course Pre-requisite(s): Objectives:

- To learn the morphological characters and structure of animals
- To inculcate the identification abilities in the learners of no- chordate diversity
- To acquire the knowledge of economic animals

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)	DSC**C5 ZOO -T5**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency	X							
II Critical thinking	X							
III Analytical reasoning	X							
IV Research skills	X							
V Team work	X							

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1. Group animals on the basis of their morphological characteristics/structures.
CO2. Demonstrate comprehensive identification abilities of Non-Chordate diversity
CO3.Explain structural and functional diversity of Non-Chordates
CO4. Develop the knowledge of economic animals.

Following is the blue print of the question paper to be followed.

Contents (As per BOS resolution dated 20.09.2022)	60 Hrs
Unit-I	**15**
Chapter 1: Protozoa to Cnidaria Phylum **Protozoa** • *Paramecium caudatum*- Morphology, Reproduction- Binary fission & Conjugation. **Phylum Porifera** • *Sycon*- Canal system. **Phylum Coelenterata:** • *Obelia*- Morphology and Reproduction.	
Chapter 2: Ctenophora to Nemathelminthes Ctenophora: • Salient feature and affinities. **Phylum Platyhelminthes:** • *Taenia solium*- Morphology and reproduction. **Phylum Nemathelminthes** • *Ascaris lumbricoides*-Morphology and Reproduction.	
Unit-II	**15**
3. Annelida • *Hirudinaria granulosa* (Leech)-Morphology and Reproduction	
4. Arthropoda • *Palaemon* (Prawn)- Morphology, Appendages, Nervous System and reproduction	
Unit-III	**15**
6. Mollusca to Hemichordata **Mollusca** • *Pila globosa*- Morphology, Shell, Respiration, Nervous System and Reproduction **Echinodermata** • *Pentoceros*- Morphology and Water Vascular System **Sub Phylum: Hemichordata** • Type Study of *Balanoglossus*–Habit and Habitat, Morphology, Coelom. • Tornaria larva. • Systematic position of Hemichordata.	
Unit-IV	**15**
7. Economic Zoology Part -I Life cycle and control of: • Gundhi Bug • Sugarcane leaf hopper • Mosquitoes	
8. Economic Zoology part II • Lac culture and Vermitechnology	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes
(As per BOS resolution dated 20.09.2022)

Following is the Mapping of the specific Course (CO's) with Program Outcomes

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	15
*Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
Total	**40 Marks**

Topics suggested for Continuous Internal Assessment Presentation/ Seminars

- **Patterns of Organization (Definition and examples).**
- Levels of organization: Protoplasmic, cellular, tissue, organ and organ system grade.
- Body symmetry: Bilateral, Radial and Biradial.
- Germ layers: Diploblastic and Triploblastic.
- Body coelom: Acoelom, Pseudocoelom and Eucoelom.
- General characters of all phyla from Protozoa to Hemichordata and classification up to classes with suitable examples.
- Canal system of sponges
- **Onychophora- Salient features and affinities**
- Soil protozoa, Spongiculture, Economic importance of corals, Vermi-technology, Importance of Honey bees as pollinators and their by-products, Chank Fisheries and economic importance of Echinodermata.
- Pisciculture: Procedure, Composite fish farming, Fish processing and preservation
- Poultry: Indigenous and exotic breeds, Poultry products and by-products
- Dairy: Artificial insemination and MOET, Milk and its by-products, Gobar gas
- Life cycle and control of termites and rodents

PRACTICAL PAPER: NON-CHORDATES AND ECONOMIC ZOOLOGY
(As per BOS resolution dated 20.09.2022)

Course Title	**Non-Chordates and Economic Zoology (Practical)**	Practical Credits	**2**
Course Code	DSC**C5 ZOO -P5**	Contact Hours	**4**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Course Pre-requisite(s):

1. **To understand the basics of** classification of non-chordates.
2. To learn the diversity of habit and habitat of these species.
3. To develop the skills to identify different classes and species of animals.
4. To know uniqueness of a particular animal and its economic importance

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

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)	**ZOO C5T**	DSCC**5ZOO -P5**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency		X						
II Critical thinking		X						
III Analytical reasoning		X						
IV Research skills		X						
V Team work		X						

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X'in the intersection cell if a course outcome addresses a particular program outcome.

Practical Content	**15**
1. Preparation and observation of protozoan culture. 2. **Protozoa**: *Amoeba*, *Euglena*, *Noctiluca*, *Paramecium* and *Vorticella* (Permanent slides). 3. **Porifera:** *Sycon, Euplectella, Hyalonema, Spongilla* and *Euspongia*	1

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

(Specimens). Study of permanent slides of T.S. of *Sycon*, spicules and gemmules.	1
4. **Coelenterata:** *Aurelia* and *Metridium* (Specimens). Slides of *Hydra*, *Obelia*-polyp and medusa, and *Ephyra* larva, T.S. of *Metridium* passing through mesenteries.	
5. **Stud y of Corals** - *Astraea, Fungia, Meandrina, Corallium, Gorgonia, Millepora* and *Pennatula.*	1
6. **Helminthes:** *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:** *Nereis*, *Sabella*, *Aphrodite* and Leech (Specimens) Slide of T.S. of Earthworm through typhlosole.	1
8. **Arthropoda**: *Palaemon*, *Astracus,* Scorpion, Spider, *Limulus, Peripatus, Millipede, Centipede,* Praying mantis, Termite Queen, Moth, Butterfly, Dung beetle / Rhinocerous beetle (Any six specimens). Crustacean Larvae-Nauplius, Zoea and Mysis.	1
9. **Mollusca:** *Chiton, Mytilus, Aplysia, Pila, Octopus, Sepia* (Specimens) and Glochidium larva (Slide).	1
10. **Shell Pattern**-*Unio, Ostrea, Cypraea, Murex, Nautilus, Patella, Dentalium,* Cuttlebone. (Any four)	
11. **Echinodermata**: Systematics of Sea-star, Brittlestar, Sea Urchin, Sea cucumber, Sea lily (Specimens). Slides of Bipinnaria larva, Echinopluteus larva and Pedicellaria.	1
12. *Balanoglossus* and its T. S. through proboscis	
13. Beneficial Non-chordates:	1
• **Sericulture:** Lifecycle of *Bombyx mori*, Uzifly, Cocoon, Raw silk.	
• **Apiculture**: Any 2 Species of honeybee and bee wax.	3
• **Pearl Culture**: Pearl Oyster and Natural Pearls.	
14. Virtual Dissection/Cultured specimens: Earthworm – Digestive system, Nervous system, Leech-Digestive System	2
15. **Virtual Dissection/Cultured specimens:** Prawn-Nervous system. Cockroach-Salivary Apparatus and Digestive system.	2

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	5
Total	**25 Marks**

Following is the blue print of the question paper to be followed.

References	(As per BOS resolution dated 20.09.2022)
1	Barnes, R.S.K.; Calow,P.; Olive,P.J.W.; Golding,D.W.; Spicer, J.I.(2002) The Invertebrates: 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. E.L.B.S. 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 Back bones. University of Chicago Press.

THEORY PAPER: CHORDATES AND COMPARATIVE ANATOMY

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

Program Name	**B.Sc., I**	Semester	**V**
Course Title	**Chordates and Comparative Anatomy (Theory)**		
Course Code:	DSC**C5 ZOO –T6**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Objectives

- To inculcate identification abilities of chordate diversity
- To explain structural and functional diversity of chordate diversity
- To understand evolutionary relationship amongst chordates

Course Outcomes (COs): After the completion of the course, the student will be able to: CO1. Demonstrate comprehensive identification abilities of chordate diversity
CO2. Explain structural and functional diversity of chordate diversity CO3. Understand evolutionary relationship amongst chordates
CO4. Take up research in biological sciences.
CO5. Realize that very similar physiological mechanisms are used in very diverse organisms. CO6. Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	DSC**C5ZOO –T6**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency			X					
II Critical thinking			X					
III Analytical reasoning			X					
IV Research skills			X					
V Team work			X					

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Contents	**60Hrs**
Unit-I	**10 hrs**
Chapter 1: Chordata • General characters of chordates and classification upto classes with suitable examples (Basic features to be emphasized). **Chapter 2: Urochordata** • Type Study of *Herdmania*- Habit and Habitat, Morphology, Ascidian Tadpole-structure and its retrogressive metamorphosis. **Chapter 3: Cephalochordata** • Type Study of *Branchiostoma* (*Amphioxus*)- Habit and Habitat, Morphology, Digestive system, Feeding mechanism, excretory and circulatory systems.	

Chapter 4: Agnatha • General characters of Agnatha and classification up to classes. • Salient features of Cyclostome with examples. • Ammocoete larva and its significance.	
Unit-II	**16 hrs**
Chapter 5: Vertebrates • General characters and Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia, Aves, Mammalia) upto living orders with examples. • Differences between Chondrichthyes and Osteichthyes. • Interesting features and evolutionary significance of Dipnoi. • Salient features of Placodermi and Ostracodermi with examples. • Interesting features of *Sphenodon*,and *Archaeopteryx.* • Interesting features of Mammalian orders (Insectivora, Carnivora, Chiroptera, Cetacea, Proboscidia, Ungulata–Perissodactyla and Artiodactyla, and Primates) with examples.	
Unit-III	**19 hrs**
Chapter 6: General account of Chordates • Origin of Chordates. • Types of caudal fins, scales and swim bladder in fishes. • Origin of Amphibia. • Neoteny and Paedogenesis. • Adaptive radiation in extinct reptiles with suitable examples. • Temporal fossae in reptiles. • Poison apparatus in snakes. • Parental care in Pisces and Amphibians. • Flight adaptations in birds. • Dentition in mammals. Evolution of molar tooth. • Migration in Pisces and Birds. • Economic zoology- Poultry	
Unit-IV	**15 hrs**
Comparative Anatomy of Vertebrates **Chapter 8: Respiratory system** • Comparative account of respiratory system in vertebrates: Pisces (*Scolidon*), Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man). **Chapter 9: Circulatory System** • Comparative account of heart and aortic arches in vertebrates: Pisces (*Scoliodon*), Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man). **Chapter 10: Excretory System** • Succession of kidney in vertebrates (Pronephros, Mesonephros and Meta nephros kidney). **Chapter 11: Nervous system** • Comparative account of brain in vertebrates: Pisces (*Scoliodon*), Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man).	

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	15
*Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
Total	**40 Marks**

Topics suggested for Continuous Internal Assessment Presentation/ Seminars

- General characters of Urochordata and Cephalochordata.
- Interesting features of crocodile
- Economic zoology- Diary, Pisciculture
- Comparative anatomy of Skeletal system: Axial and appendicular.
- Comparative account of heart in vertebrates
- Comparative account of brain in vertebrates

Practical Paper: Chordates and Comparative Anatomy Zoology

Following is the blue print of the question paper to be followed.

Course Title	**Chordates and Comparative Anatomy Zoology (Practical)**	Practical Credits	**2**
Course Code	DSC**C5 ZOO –P6**	Contact Hours	**4**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

(As per BOS resolution dated 20.09.2022)

Course Pre-requisite(s): Objectives

- To inculcate identification abilities of chordate diversity
- To explain structural and functional diversity of chordate diversity
- To understand evolutionary relationship amongst chordates

Course Outcomes (COs): After the completion of the course, the student will be able to: CO1. Demonstrate comprehensive identification abilities of chordate diversity
CO2. Explain structural and functional diversity of chordate diversity CO3. Understand evolutionary relationship amongst chordates

Practical Content	**15 units**
1. **Protochordata** Ascidia/*Herdmania* and Amphioxus, T.S. of *Amphioxus* through pharynx and intestine.	**1**
2. **Cyclostomata** *Petromyzon*, Ammocoete larva and *Myxine.*	
3. **Pisces** Cartilaginous Fishes – *Narcine, Trygon, Pristis, Myolobatie*s Bony Fishes–Zebra fish, *Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon, Echeneis*. (Any four).	**1**
4. **Ornamental fishes** Siamese, Koi, Oscar, Betta Sp., Neon tetra, Guppies, Goldfish, Angle fish, Rainbow fish, Mollies (Locally available any five aquarium fishes).	**1**
5. **Accessory respiratory organs** *Saccobranchus, Clarias* and *Anabas.*	**1**
6. **Amphibia** - *Rana*, *Bufo, Ambystoma, Axolotl larva, Necturus and Ichthyophis.*	
7. **Reptilia** Turtle, Tortoise, *Mabuya, Calotes,* Chameleon, *Varanus*.	**1**
snakes–*Dryophis*, Rat snake, Brahmini, Cobra, Krait, Russell's viper and *Hydrophis* (Any 4)	**1**
8. **Aves** Beak and feet modifications in Duck, Crow, Sparrow, Parrot, Kingfisher, Eagle or Hawk. (Any four)	**1**
9. **Mammalia** Mongoose, Squirrel, Pangolin, Hedge Hog, Rat and Loris. (Any four)	**1**
10. **Virtual Dissection/Cultured specimens** Shark/Bony fish: Afferent and efferent branchial systems, glosso-pharyngeal and vagus nerves.	**3**
Rat: Dissection (only demonstration) – Circulatory system (arterial and venous), Urogenital system.	**2**
11. **Skeletal System in Frog and man (Comparative Anatomy):** Skull, vertebrae, girdles and limb bones (Except hands and feet)	**2**
12. Integumentary System (Comparative Anatomy) Structure of skin in Fish, Frog, Bird and mammal Integumentary derivatives in mammals.	

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	5
Total	**25 Marks**
Formative Assessment as per NEP guidelines are compulsory	

References	
1	Colbert *et al*: Colbert's Evolution of the Vertebrates:A history of the back boned animals through time. (5th ed 2002, Wiley–Liss).
2	Hildebrand: Analysis of vertebrate Structure (4thed 1995, JohnWiley)
3	Kenneth V. Kardong (20015) vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill
4	McFarland *et al.,*: Vertebrate Life (1979, Macmillan publishing)
5	Parker and Haswell: Text Book of Zoology, Vol. II(1978,ELBS)
6	Romerand Parsons: The Vertebrate Body (6thed1986, CBS Publishing Japan)
7	Young: The Life of vertebrates (3rded 2006,ELBS/Oxford)
8	Weichert C. K. and William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills
9	Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw-Hill.

Scheme of Practical Examination

Following is the blue print of the question paper to be followed.

V Semester

(As per BOS resolution dated 20.09.2022)

PAPER V: DSC**C5 ZOO P5: Non- Chordata & Economic Zoology**

(Practical based on DSC**C5 ZOO -T5)**

Duration: 03 Hours Max. Marks: 25

I. Dissect & display/ Chart
   Earthworm/Cockroach: Nervous system/Digestive system (08 M)
II. Dissect & display/ Chart
   Leech: Digestive system/ Cockroach: Salivary gland apparatus (05M)
III. Identify, classify & comment on spots A, B, C and D (3X4 = 12 M)
   (One from Economic Zoology and one slide is compulsory)

Scheme of Valuation

I – Dissection – 06M; Display – 02 M/ Comments with diagram-8M
II – Mounting – 03M; Comments – 02M/ Comments with diagram-6M
III – Identification & classification – 01M; Diagram & comments – 02M for Each

V Semester

Following is the blue print of the question paper to be followed.

PAPER VI: DSCC5 **ZOO P6: Chordata & Comparative Anatomy**
(As per BOS resolution dated 20.09.2022)
(Practical Based on DSCC5 **ZOO –16)**

Duration: 3 Hours Max. Marks: 25

Scheme of Examination

I. Flag labeling of the display/ Chart given (ONE) [08M]

a. Shark – Afferent/Efferent/Cranial nerves
b. Rat – Circulatory system/Urinogenital system (Arterial/venous) (Male/Female)

II. Comparative anatomy (ONE) [05M]

a. Skeletal system or Integumentary system for comparison
b. Any TWO derivatives of mammalian integument

III. Identification and comment on spotters A to D [3X4 = 12 M]

a. (Slides & Specimens from Protochordates to Mammalia)
b. One slide is compulsory

Scheme of Valuation

I. Identification of the system – 02M; Flag labeling – 06M (Minimum 06 labels)/ Comments with diagram-8M
II. Diagram & Comments – 05M
III. Identification with classification – 01M; Diagram & Comments – 02 M for each

***

Following is the blue print of the question paper to be followed.

VI SEMESTER CURRICULUM

(As per BOS resolution dated 20.09.2022)

Program Name	**B.Sc.,**	Semester	**VI**
Course Title	**Evolutionary & Developmental Biology (Theory)**		
Course Code:	DSC**C5 ZOO –T7**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/ Exam	**2hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Objectives

- To understand the biological evolution on the earth
- To understand various forces influencing the evolution
- To understand how the single cell formed at fertilization forms an embryo and then a full adult organism.

Course Outcomes(COs): After the successful completion of the course, the student will be able to:

- Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.
- Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change.
- Understand how the single cell formed at fertilization forms an embryo and then a full adult organism.
- Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.
- Understand a variety of interacting processes, which generate an organism's heterogeneous shapes, size, and structural features.
- Understand how a cell behaves in response to an autonomous determinant or an external signal, and the scientific reasoning exhibited in experimental life science.

Course Articulation Matrix: Mapping of Course Out comes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	DSC**C5 ZOO –T7**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency					X			
II Critical thinking					X			
III Analytical reasoning					X			
IV Research skills					X			
V Team work					X			

Contents	60Hrs
Unit-I	**15**
1. **Theories of Evolution** • Origin of Life (Contributions of Oparin, Haldane, Stanley Miller's experiment). • Historical review of Lamarckism, Darwinism, Modern synthetic theory. • Adaptive radiations: Patterns of evolution (Divergence, Convergence, Parallel, Co-evolution)	
2. **Population Genetics** • Microevolution and Macroevolution: allele frequencies, genotype frequencies, Hardy- Weinberg equilibrium • Forces of evolution: Mutation, Natural Selection (Introduction, Types- Stabilising selection, Disruptive selection, Directional selection), Genetic drift (Introduction, Types- Founder's effect, Bottle neck effect).	
Unit-II	**15**
3. **Direct Evidences of Evolution:** • Fossils- Types of fossils (Petrifactions, Preservations, Impressions, Moulds and casts), Dating of fossils (Carbon-14 dating method and U-Pb dating method) • Phylogeny of horse (Eohippus, Mesohippus, Merichippus, Pliohippus and Equus).	
4. **Species Concept and Extinction**: • Biological species concept (Advantages and Limitations) • Modes of Speciation-Allopatric and Sympatric speciation (Pre- zygotic and Post Zygotic reproductive isolating mechanisms to be emphasized). • Mass extinction (Causes, Names of five major extinctions).	
Unit-III	**15**
5. **Gamete, Fertilization and Early Development:** Gametogenesis (mechanism of Spermatogenesis and oogenesis), Fertilization, Cleavage pattern, Gastrulation and fate map and morphogenesis- General account in the light of evolution to be emphasized.	
6. **Developmental Genes:** • General concepts of Organogenesis-I (Neurulation process) • Introduction to genetic basis of embryonic development and Developmental control genes (Homeobox genes)	
Unit-IV	**15**
7. **Early Vertebrate Development**: • Early development of mammals including Placentation, metamorphosis, regeneration (Limb in frog), environmental regulation in Frog.	
8. **Late Development**: • Development of eye and kidney • Mammalian female reproductive cycles- estrous cycle and menstrual cycle and their regulation • Aging: biology of senescence (causes of ageing to be emphasized)	

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

Formative Assessment for Theory	
Assessment Occasion /type	**Marks**
House Examination/ Test	15
Written Assessment /Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
Total	**40 Marks**
Formative Assessment as per NEP guidelines are compulsory	

Topics suggested for Continuous Internal Assessment Presentation/ Seminars

- Incomplete fossil record.
- Planes of cleavage
- Types of cleavage
- Influence of yolk on cleavage
- Historical embryology
- Cleidoic egg and its significance
- Mosaic and regulative eggs
- Theories of ageing
- Blastulation – a general account

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Following is the blue print of the question paper to be followed.

Practical Papers: Evolutionary & Developmental Biology
(As per BOS resolution dated 20.09.2022)

Program Name	**B.Sc.,**		Semester	**VI**
Course Title	**Evolutionary & Developmental Biology(Practical)**			
Course Code:	DSC**C5 ZOO –P7**		No. of Credits	**2**
Contact hours	**60 Hours**		Duration of SEA/ Exam	**3 hours**
Formative Assessment Marks	**25**		Summative Assessment Marks	**25**

Course Pre-requisite(s): Course Pre-requisite(s): Objectives

- To understand the biological evolution on the earth
- To understand various forces influencing the evolution
- To understand how the single cell formed at fertilization forms an embryo and then a full adult organism.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	DSC**C5 ZOO –P7**	**ZOO C8T**	**ZOO C8P**
I Core competency						X		
II Critical thinking						X		
III Analytical reasoning						X		
IV Research skills						X		
V Team work						X		

Course Articulation Matrix relates course out comes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program outcome.

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance / Participation	10
Total	**25 Marks**
Formative Assessment as per NEP guide lines are compulsory	

Practical Content	15
1. Study of fossils from models/ pictures.	2
2. Study of homology and analogy from suitable specimens	2
3. Study and verification of Hardy-Weinberg Law by chi square analysis.(Any three problems)	1
4. Types of eggs based on quantity and distribution of yolk: Sea urchin, insect, frog , Chick.	2
5. Study of adaptive radiations in feet of birds and mouth parts of insects.	2
6. Study of mammalian placenta- Histological and morphological types	2
7. Chick Embryology: Egg, Sperm, Primitive streak, 24H, 36H and 48 Hours embryo whole mount.	2
8. Evolution of man- Ramapithecus, Australopithecus, Neanderthal man and Cromagnon man	2

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

References	
1	Ridley, M (2004) Evolution (3rd edition) Black well Publishing
2	Hall, B.K. and Hallgrimson, B (2008) Evolution (4th edition) Jones and Barlett Publishers
3	Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
4	Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
5	Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
6	Developmental Biology: T. Subramaniam, (Reprint), Narosa Publishing House Pvt. Ltd., New Delhi
7	Developmental biology: Werner A. Müller, Springer Science & Business Media. (2012).
8	Human Embryology and Developmental Biology E-Book: Bruce M. Carlson, Elsevier Health Sciences.
9	Developmental Biology: Michael J. F. Barresi, Scott F. Gilbert, Oxford University Press. (2019).

PAPER: ENVIRONMENTAL BIOLOGY, WILDLIFE MANAGEMENT &CONSERVATION (THEORY)

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Program Name	**B.Sc.,**		Semester	**VI**
Course Title	**Environmental Biology, Wildlife Management &Conservations (Theory)**			
Course Code:	DSC**C5 ZOO –T8**		No. of Credits	**4**
Contact hours	**60 Hours**		Duration of SEA/Exam	**2Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Objectives

- **To understand the interaction between the animals and abiotic factors in the environment**
- To use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.
- **To** gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Develop an understanding of how animals interact with each other and their natural environment.
CO2. Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.
CO3.Develop the ability to work collaborative team-based projects.
CO4.Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.
CO5.Develop an ability to analyze, present and interpret wildlife conservation Management in formation.

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	DSC**C5 ZOO – T8**	**ZOO C8P**
I Core competency							X	
II Critical thinking							X	
III Analytical reasoning							X	
IV Research skills							X	
V Team work							X	

Contents	**60 Hrs**
Unit-I	**15**
1 **Ecology:** • Introduction to ecology, Definition, ecosystem, trophic levels, food chain and food web. • Aquatic environment (Pond and marine) • Biomes – definition, Terrestrial (Tundra, alpine, forest, tropical savanna, grassland, desert, wetland) • Ecological factors (Biotic and Abiotic)	

Unit-II	15
2. **Pollution:** • Definition, types (air, soil, water and thermal), ozone layer depletion, bioaccumulation, Biomagnification and bioremediation. • Effects of all pollution types on animals and plants	
Unit-III	**15**
3. **Wildlife Conservation:** Causes and depletion of wildlife, Ex-situ and in-situ conservation, National parks, Wildlife sanctuaries, biosphere reserve. Project tiger. Project Elephant, Project Lion, breeding in captivity, Zoological gardens, Wildlife Protection Act 1972.	
Unit-IV	**15**
4. Wildlife Management: Values of wildlife, inventory and classification of wetlands and their biotic components, general strategies and issues, concept of home range, wildlife corridors and territory, animal census, tracing movement and remote sensing and GIS.	

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs1-15)

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/ Participation	10
Total	**40Marks**
Formative Assessment as per NEP guidelines are compulsory	

Topics suggested for Continuous Internal Assessment Presentation/ Seminars

- Adaptive features of plants and animals to different environment
- Factors: Weather, Climate, Light, soil, temperature
- Biodiversity- Types, hotspots and methods of preservation

PAPER: ENVIRONMENTAL BIOLOGY, WILDLIFE MANAGEMENT &CONSERVATIONS (PRACTICAL)

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Course Title	**Environmental Biology, Wildlife Management & Conservation (Practicals)**	Practical Credits	**2**
Course Code	DSC**C5 ZOO –P8**	Contact Hours	**4 Hours**
Formative Assessment	**25Marks**	Summative Assessment	**25 Marks**

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency								X
II Critical thinking								X
III Analytical reasoning								X
IV Research skills								X
V Team work								X

Practical Content	**15**
1. **Water quality parameters assessment:** Collection of water sample, Dissolved Oxygen (O_2), Carbon dioxide (CO_2), Biological Oxygen Demand (BOD) Chemical Oxygen Demand (COD), chlorides, Hardness and salinity estimation in water. (Any four)	5
2. **Analysis of physico-chemical parameters of soil:** pH, soil moisture, soil temperature, organic matter in soil.	3
3. Analysis of air pollution: Air monitoring for particulate matter	1
4. Visit of pond and lakes: Collection and identification of fauna of selected ecosystems. Collection, preservation of phytoplanktons, zooplanktons and insect larva..	1
5. Demonstration of field equipments used in wildlife census: Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of cameras and lenses.	2
6. Identification wild animals: Wild animal's pugmarks, hoof marks scars, pellet groups, nest, antlers. Demonstration of field techniques for wild fauna.	1
7. Field visit to nearby National park/ Wildlife sanctuary/ any National laboratory at the end of semester is compulsory and the report of this is to be submitted along with practical record as a part of practical examination.	2

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

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Written Assessment /Presentation/Project/Term Papers/Seminars	10
Classroom Performance /Participation	10
Total	**25Marks**
Formative Assessment asper NEP guidelines are compulsory	

References	
1	Colinvaux, P. A.(1993) Ecology (2nd edition)Wiley, John and Sons, Inc.
2	Krebs,C. J.(2001)Ecology(6th edition) Benjamin Cummings.
3	Odum,E.P., (2008) Fundamentals of Ecology. IndianEdition. Brooks/Cole. (3rd Edition) BlackwellSci.
4	Kendeigh, FC.(1984) Ecology with Special Reference to Animal and Man. Prentice HallInc.
5	Caughley,G. and Sinclair, A.R.E.(1994)Wildlife Ecology and Management. Blackwell Science.
6	Woodroffe,R., Thirgood, S. and Rabinowitz,A. (2005) People and Wildlife, Conflict Or Co-existence? Cambridge University.
7	Bookhout,T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society,Allen Press.
8	Sutherland, W.J. (2000)The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
9	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

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Scheme of Practical Examination

VI Semester

Paper VII: DSCC5 ZOO –P7; Evolutionary and Developmental Biology

(Practical Based on DSC**C5 ZOO –T7)**

Duration: 03 Hours **Max. Marks 25 M**

Practical Examination Scheme

I. Identify and comment on spotters A and B 3X2 = 06M
(Homologous/Analogous organ/Fossil Model) (Any Two)

II. Problem on Hardy-Weinberg Law- Chi square analysis (Problems related to evolution) 04 M

III. Identify and comment on slide C, D and E 3X4 = 12M
(Frog/Chick embryology slides)

IV. Identify and comment on F 03M
(Any one Human fossil)

Scheme of Valuation

I. Identification -01 M; Comments - 02M for each

II. Problem 04 M

III. Identification 01 M; Comment with diagram 03 M

IV. Identification 01M; Comments 02M

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Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

VI Semester

Paper VIII: DSC**C5 ZOO –P8 :Environmental Biology Wildlife Management and Conservation**
(Practical Based on DSC**C5 ZOO –T8)**

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

I. Estimation of given Water sample for (any one) 12 M
(Dissolved O_2/CO_2/Hardness/Chloride)

II. Detect the Physico-chemical parameter of the soil (any one) 04 M
(pH, Moisture, Soil temperature, Organic matter)

III. Identify and Comment of the spot A & B 3X2 = 06 M
(Zooplanktons & Fauna of any ecosystem).

IV. Identify the spot C 03 M
(Binocular, Compass, Lens, Camera, GPS and Spotting Scope).

Scheme of Valuation

I. Principle and procedure -06 M
Conducting – 04M
experiments Result & - 02M
Comment

II. Physical parameter - 03M
Comment - 01M

III. Identification - 01M
Comment - 02 M

IV. Identification - 01M
Comment with Application - 02M

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For B.Sc., III Year V and VI semesters

Following is the blue print of the question paper to be followed.

ZOOLOGY AND ANOTHER SUBJECT AS DOUBLE MAJORS IN THIRD YEAR

Sem	Disp.	Paper Code	Title	C	T	P	Ex	IA	E	T
V	DSC	**C5 ZOO -T5**	Non-chordates and Economic Zoology	4	4		2 hr	40	60	100
		C5 ZOO -P5	Practical Based on Zoo **C5 ZOO -T5**	2		4	3 hr	25	25	50
		C5 ZOO -T6	Chordates and Comparative Anatomy	4	4		2 hr	40	60	100
		C5 ZOO -P6	Practical Based on **C5 ZOO -T6**	2		4	3 hr	25	25	50
VI	DSC	**C5 ZOO -T7**	Evolutionary & Developmental Biology	4	4		2 hr	40	60	100
		C5 ZOO -P7	Practical Based on **C5 ZOO -T7**	2		4	3 hr	25	25	50
		C5 ZOO -T8	Environmental Biology,Wildlife Management & Conservation	4	4		2 hr	40	60	100
		C5 ZOO -P8	Practical Based on **C5 ZOO -T8**	2		4	3 hr	25	25	50

(C: credits; T: theory; P: Practical; Ex: Exam Duration; IA: Internal Assessment; E: Exam marks; T: Total)

Internship Allotment:

Since Double Majors Programme Being Followed in Third Year, Students Can Opt/choose Eighter Zoology Or Another Subject as Internship topic.

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(Semester Scheme with Multiple Entry and Exit Options for Under Graduate Course)

Syllabus for Zoology
(V & VI Semester)

2023-24

Guidelines For Model Curriculum

1. The Universities shall promote Double Major model as prescribed in the Model Curriculum Table.
2. For Arts/Humanities/Social Science - V & VI sem, three core papers (DSC) to be selected in each semester.
   For Science – Ensure two core papers (DSC) should get minimum of 12 credits/or 2 major subjects of 24 credits (4+2 patterns)
   (1 hour of Lecture or 2 hours of practical/field work per week in a semester is assigned one credit and core subject theory courses/papers will have 4 credits, while practical are assigned 2 credits)
3. Formative assessment and summative assessment to be followed in the ratio of 40:60.
4. Selection of Open electives: The university shall follow curriculum and credit frame work for Undergraduate program of published by UGC. **Open Electives – Courses from other Disciplines (9 Credits)**
   - Students are not allowed to choose or repeat courses as open electives already undergone at the higher secondary level (12th class)
   - All UG students are required to undergo 3 introductory-level courses relating to any of the broad disciplines given below.

Natural and Physical Sciences	Mathematics, Statistics, & Computer Applications	Library, Information, and Media Sciences	Commerce and Management	Humanities and Social Sciences:
Students can choose basic courses from disciplines such as Natural Science, for example, Biology, Botany, Zoology, Biotechnology, Biochemistry, Chemistry,	Courses under this category will facilitate the students to use and apply tools and techniques in their major and minor disciplines. The course may include training in programming software like Python among others and applications software	Courses from this category will help the students to understand the recent developments in information and media science (journalism, mass media, and communication)	Courses include business management, accountancy, finance, financial institutions, fintech, etc.,	The courses relating to Social Sciences, for example, Anthropology, Communication and Media, Economics, History, Linguistics, Political Science, Psychology, Social Work, Sociology, etc. will enable students to understand the individuals and their social behavior, society, and nation. Students be introduced to survey methodology and available large-scale databases
Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental Sciences, etc.	like STATA, SPSS, Tally, etc. Basic courses under this category will be helpful for science and social science in data analysis and the application of quantitative tools			for India. The courses under humanities include, for example, Archaeology, History, Comparative Literature, Arts & Creative expressions, Creative Writing and Literature, language(s), Philosophy, etc., and interdisciplinary courses relating to humanities. The list of Courses that can include interdisciplinary subjects such as Cognitive Science, Environmental Science, Gender Studies, Global Environment & Health, International Relations, Political Economy and Development, Sustainable Development, Women's and Gender Studies, etc. will be useful to understand society.

Following is the blue print of the question paper to be followed.

BSc.-Science: Curriculum and Credit Framework for Undergraduate Programme

Sem.	Discipline Specific Courses - Core (DSC), Elective (DSE)(Credits) (L+T+P)	Minor/ Multidisciplinary/ Open Elective (OE) Courses(Credits) (L+T+P)	Ability Enhancement Courses (AEC)(Credits)(L+T+P) (Languages)	Skills Enhancement Courses (SEC) (Credits) (L+T+P)/ Value Added Courses (Credits) (L+T+P) (common for all UG Programs)/ Summer Internship.		Total Credits
I	DSC-A1(4), A2(2) DSC-B1(4), B2(2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs each)	**SEC-1**: Digital Fluency (2) (1+0+2)/ Env. Studies (3)	Health, Wellness & Yoga (2) (1+0+2)	25/26
II	DSC-A3(4), A4(2), DSC-B3(4), B4(2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs each)	Env. Studies (3)/ SEC-1: Digital Fluency (2)(1+0+2)	Sports/NCC/NSS/R&R(S&G) / Cultural (2) (0+0+4)	26/25
Students exiting the programme after securing 46 credits will be awarded UG Certificate in Disciplines A and B provided they secure 4 credits in work based vocational courses during summer term or internship/Apprenticeship in addition to 6 credits from skill-based courses earned during the first year.						
III	DSC-A5(4), A6(2), DSC-B5(4), B6(2)	OE-3 (3)/ India and IndianConstitution (3)	L1-3(3), L2-3(3) (4 hrs. each)	**SEC-2**:AI/Cyber Security/Finan- cial Edu. & Inv. Aw. (2) (1+0+2)	Sports/NCC/NSS/R&R(S&G) /Cultural (2) (0+0+4)/ SEC (2)	25
IV	DSC-A7(4), A8(2), DSC-B7(4), B8(2)	India and Indian Constitution (3) / OE-3(3)	L1-4(3), L2-4(3) (4 hrs. each)	**SEC-3**: Financial Edu. &Inv. Aw. /AI /Cyber Security (2) (1+0+2)	Sports/NCC/NSS/R&R(S&G)/ Cultural (2) (0+0+4)/ SEC (2)	25
Students exiting the programme after securing 92 credits will be awarded UG Diploma in Disciplines A and B provided they secure additional 4 credits in skill based vocational courses offered during first- or second-year summer term.						
V	DSC-A9(4), A10(2), A11(4), A12(2);	DSC-B9(4), B10(2), B11(4), B12(2)		**SEC-4**: Employability Skills/Cyber Security (3) (2+0+2)		27
VI	DSC-A13(4), A14(2), A15(4), A16(2);	DSC-B13(4), B14(2), B15(4), B16(2)		Internship (2)		26
Students exiting the programme after 3-years will be awarded UG Degree in Disciplines A and B as double majors upon securing 136 credits and satisfying the minimum credit requirements under each category of courses prescribed.						

Internship for graduate Programme (As Per UGC & AICTE)

Course title	Internship Discipline specific
No of contact hours	90
No credits	2
Method of evaluation	Presentations/Report submission/Activity etc.,

- Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session)
- Internship mentor/supervisor shall avail work allotment during 6th semester for a maximum of 20 hours.
- The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC and AICTE guidelines.

Following is the blue print of the question paper to be followed.

SUBJECT EXPERT COMMITTEE MEMBERS -KSHEC
(As per BOS resolution dated 20.09.2022)

S. No.	Name and Organization	Designation
1	Prof. K. Vijaykumar, Department of Zoology, Gulbarga University, Kalaburagi. Ph:.9480060508,katepaga63@gmail.com	Chairman
2	Prof. P.M Basha, Department of Zoology, Bangalore University, Bengaluru Ph:.9448701652, pmbashabub@rediffmail.com	Member
3	Prof. Vijaykumar B Malashetty, Department of Zoology, VSK University, Ballari. Ph:.9343011567,vijaymalashetty@gmail.com	Member
4	Prof. S. Basavarajappa, Mysore University, Mysuru. Ph:.9449203241, E-mail: ornithoraj11@gmail.com	Member
5	Prof. Nagaraj, Department of Zoology, Kuvempu University, Shivamogga. Ph:.9620485338	Member
6	Prof. Kareemunnisa Syed, Nrupathunga University, Bengaluru, Ph:.9964300991, kareemunnisa66@gmail.com	Member
7	Prof. B. Vasanthkumar, Department of Zoology, Sir MVGovt. College,Bhadravathi,Shimoga	Member
8	Prof. B.K. Meera, Professor, Maharani Cluster University, Bengaluru Ph:.9886409382.	Member
9	Dr. D. Gangadhara Rao, Professor, Govt. Women's College, Kolar. Ph:.9448984956	Member
10	Prof. Shankarappa S.Hatti, Govt. College, Dept. of Zoology, SedamRoad,Kalaburagi.9980391964	Member
11	Dr. Zeba Parveen Dept. Of Zoology, Bi Bi Raza Women's Degree College, Kalaburagi. Ph:.9448092786	Member
12	Dr. Asiya Nuzhath F.B, Associate Professor, Dept. Of Zoology, Tumkur University, Tumakuru. Ph:.9844029441	Member
13	Ms. Akshatha, Special Officer, KSHEC, Bengaluru. Ph:.9535487108	Member Convener

Following is the blue print of the question paper to be followed.

Bengaluru City University Subject Committee BOS members for Zoology

(As per BOS resolution dated 20.09.2022)

SN	Name& Organization	Designation
1	Dr. P. MAHABOOB BASHA, Prof. of Zoology, Bangalore University, Bangalore-560056.	Chairman
2	Dr. HEMALATHA A. Prof. of Zoology, Maharani Cluster University, Bangalore- 560001.	Member
3	Dr. SHABANA BEGUM. Prof. of Zoology, Maharani Cluster University Bangalore- 560001	Co-opted Member(E)
4	Dr. LATHA, V. Asso. Prof. of Zoology, Maharani Cluster University, Bangalore- 560001	Co-opted Member(E)
5	Mr. CHANDRAPPA, Associate Prof. of Zoology, GFGC, Yelahanka, Bangalore. 9886884996.	Member
6	Mrs. DHANALAKSHMI. N, Asst. Prof of Zoology, Vijaya College, RV Road, Bangalore-560004.	Member
7	Dr. C.E. TRIVENI, V.V. Puram College of Science, K. R. Road, Bangal	Member
8	Dr. SHUBHA M, Assistant Professor in zoology, BMS College for Women, Bengaluru-560004.	Member
9	Dr. BHUSHANAM. Asso. Prof. of Zoology, Maharani Cluster Universit Bangalore- 560001	Co-opted Member(E)

Note:

1. Sl. No 3-4 & 9 were co-opted in the place of Superannuated BOS members.

(P. MAHABOOB BASHA)
Chairman, BOS (UG)Zoology, BCU

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

VI SEMESTER CURRICULUM

Program Name	**B.Sc.,**	Semester	**VI**
Course Title	**Evolutionary & Developmental Biology (Theory)**		
Course Code:	DSC**C5 ZOO –T7**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/ Exam	**2hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s): Objectives

- To understand the biological evolution on the earth
- To understand various forces influencing the evolution
- To understand how the single cell formed at fertilization forms an embryo and then a full adult organism.

Course Outcomes(COs): After the successful completion of the course, the student will be able to:

- Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.
- Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change.
- Understand how the single cell formed at fertilization forms an embryo and then a full adult organism.
- Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.
- Understand a variety of interacting processes, which generate an organism's heterogeneous shapes, size, and structural features.
- Understand how a cell behaves in response to an autonomous determinant or an external signal, and the scientific reasoning exhibited in experimental life science.

Course Articulation Matrix: Mapping of Course Out comes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	DSC**C5 ZOO –T7**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency					X			
II Critical thinking					X			
III Analytical reasoning					X			
IV Research skills					X			

V Team work

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Contents	60Hrs
Unit-I	**15**
1. **Theories of Evolution** • Origin of Life (Contributions of Oparin, Haldane, Stanley Miller's experiment). • Historical review of evolutionary concept: Lamarckism, Darwinism, Modern synthetic theory • Adaptive radiations: Patterns of evolution (Divergence, Convergence, Parallel, Co-evolution)	
2. **Population Genetics** • Microevolution and Macroevolution: allele frequencies, genotype frequencies, Hardy- Weinberg equilibrium • Forces of evolution: Mutation, Natural Selection (Introduction, Types- Stabilising selection, Disruptive selection, Directional selection), Genetic drift (Introduction, Types- Founder's effect, Bottle neck effect).	
Unit-II	**15**
3. **Direct Evidences of Evolution:** • Fossils- Types of fossils (Petrifactions, Preservations, Impressions, Moulds and casts), Dating of fossils (Carbon-14 dating method and U-Pb dating method) • Phylogeny of horse (Eohippus, Mesohippus, Merichippus, Pliohippus and Equus).	
4. **Species Concept and Extinction**: • Biological species concept (Advantages and Limitations) • Modes of Speciation-Allopatric and Sympatric speciation (Pre- zygotic and Post Zygotic reproductive isolating mechanisms to be emphasized). • Mass extinction (Causes, Names of five major extinctions).	
Unit-III	**15**
5. **Gamete, Fertilization and Early Development:** Gametogenesis (mechanism of Spermatogenesis and oogenesis), Fertilization, Cleavage pattern, Gastrulation and fate map and morphogenesis- General account in the light of evolution to be emphasized.	
6. **Developmental Genes:** • General concepts of Organogenesis-I (Neurulation process) • Introduction to genetic basis of embryonic development and Developmental control genes (Homeobox genes)	
Unit-IV	**15**

7. **Early Vertebrate Development**: • Early development of mammals including Placentation, metamorphosis, regeneration (Limb in frog), environmental regulation in Frog.	
8. **Late Development**: • Development of the blood kidney • Mammalian female reproductive cycles, menstrual cycle and their regulation • Aging: biology of senescence (causes of ageing to be emphasized)	

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Formative Assessment for Theory	
Assessment Occasion /type	**Marks**
House Examination/ Test	15
Written Assessment /Presentation/Project/Term Papers/Seminars	15
Classroom Performance/Participation	10
Total	**40 Marks**
Formative Assessment as per NEP guidelines are compulsory	

Topics suggested for Continuous Internal Assessment Presentation/ Seminars

- Incomplete fossil record.
- Planes of cleavage
- Types of cleavage
- Influence of yolk on cleavage
- Historical embryology
- Cleidoic egg and its significance
- Mosaic and regulative eggs
- Theories of ageing
- Blastulation – a general account

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Following is the blue print of the question paper to be followed.

Practical Paper: Evolutionary & Developmental Biology

(As per BOS resolution dated 20.09.2022)

Program Name	**B.Sc.,**	Semester	**VI**
Course Title	**Evolutionary & Developmental Biology(Practical)**		
Course Code:	DSC**C5 ZOO –P7**	No. of Credits	**2**
Contact hours	**60 Hours**	Duration of SEA/ Exam	**3 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

Course Pre-requisite(s): Course Pre-requisite(s): Objectives

- To understand the biological evolution on the earth
- To understand various forces influencing the evolution
- To understand how the single cell formed at fertilization forms an embryo and then a full adult organism.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	DSCC5 **ZOO –P7**	**ZOO C8T**	**ZOO C8P**
I Core competency						X		
II Critical thinking						X		
III Analytical reasoning						X		
IV Research skills						X		
V Team work						X		

Course Articulation Matrix relates course out comes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program outcome.

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance / Participation	10
Total	**25 Marks**
Formative Assessment as per NEP guide lines are compulsory	

Practical Content	15
1. Study of fossils from models/ pictures.	2
2. Study of homology and analogy from suitable specimens	2
3. Study and verification of Hardy-Weinberg Law by chi square analysis.(Any three problems)	1
4. Types of eggs based on quantity and distribution of yolk: Sea urchin, insect, frog , Chick.	2
5. Study of adaptive radiations in feet of birds and mouth parts of insects.	2
6. Study of mammalian placenta- Histological and morphological types	2
7. Chick Embryology: Egg, Sperm, Primitive streak, 24H, 36H and 48 Hours embryo whole mount.	2
8. Evolution of man- Ramapithecus, Australopithecus, Neanderthal man and Cromagnon man	2

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

References	
1	Ridley, M (2004) Evolution (3rd edition) Black well Publishing
2	Hall, B.K. and Hallgrimson, B (2008) Evolution (4th edition) Jones and Barlett Publishers
3	Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
4	Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
5	Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
6	Developmental Biology: T. Subramaniam, (Reprint), Narosa Publishing House Pvt. Ltd., New Delhi
7	Developmental biology: Werner A. Müller, Springer Science & Business Media. (2012).
8	Human Embryology and Developmental Biology E-Book: Bruce M. Carlson, Elsevier Health Sciences.
9	Developmental Biology: Michael J. F. Barresi, Scott F. Gilbert, Oxford University Press. (2019).

PAPER: ENVIRONMENTAL BIOLOGY, WILDLIFE MANAGEMENT &CONSERVATION (THEORY)

Following is the blue print of the question paper to be followed.

Program Name	**B.Sc.,**	Semester	**VI**
Course Title	**Environmental Biology, Wildlife Management &Conservations (Theory)**		
Course Code:	DSC**C5 ZOO –T8**	No. of Credits	**4**
Contact hours	**60 Hours**	Duration of SEA/Exam	**2Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

(As per BOS resolution dated 20.09.2022)

Course Pre-requisite(s): Objectives

- **To understand the interaction between the animals and abiotic factors in the environment**
- To use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.
- **To** gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Develop an understanding of how animals interact with each other and their natural environment.
CO2. Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.
CO3.Develop the ability to work collaborative team-based projects.
CO4.Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.
CO5.Develop an ability to analyze, present and interpret wildlife conservation Management in formation.

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	DSC**C5 ZOO – T8**	**ZOO C8P**
I Core competency							X	
II Critical thinking							X	
III Analytical reasoning							X	
IV Research skills							X	
V Team work							X	

Contents	**60 Hrs**
Unit-I	**15**
1 **Ecology:** • Introduction to ecology, Definition, ecosystem, trophic levels, food chain and food web. • Aquatic environment (Pond and marine) • Biomes – definition, Terrestrial (Tundra, alpine, forest, tropical savanna, grassland, desert, wetland) • Ecological factors (Biotic and Abiotic)	

Unit-II	15
2. **Pollution:** • Definition, types (air, soil, water and thermal), ozone layer depletion, bioaccumulation, Biomagnification and bioremediation. • Effects of all pollution types on animals and plants	
Unit-III	**15**
3. **Wildlife Conservation:** Causes and depletion of wildlife, Ex-situ and in-situ conservation, National parks, Wildlife sanctuaries, biosphere reserve. Project tiger. Project Elephant, Project Lion, breeding in captivity, Zoological gardens, Wildlife Protection Act 1972.	
Unit-IV	**15**
4. Wildlife Management: Values of wildlife, inventory and classification of wetlands and their biotic components, general strategies and issues, concept of home range, wildlife corridors and territory, animal census, tracing movement and remote sensing and GIS.	

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs1-15)

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	15
Written Assessment/Presentation/Project/Term Papers/Seminars	15
Classroom Performance/ Participation	10
Total	**40Marks**
Formative Assessment as per NEP guidelines are compulsory	

Topics suggested for Continuous Internal Assessment Presentation/ Seminars

- Adaptive features of plants and animals to different environment
- Factors: Weather, Climate, Light, soil, temperature
- Biodiversity- Types, hotspots and methods of preservation

PAPER: ENVIRONMENTAL BIOLOGY, WILDLIFE MANAGEMENT &CONSERVATIONS (PRACTICAL)

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Course Title	**Environmental Biology, Wildlife Management & Conservation (Practicals)**	Practical Credits	**2**
Course Code	DSC**C5 ZOO –P8**	Contact Hours	**4 Hours**
Formative Assessment	**25Marks**	Summative Assessment	**25 Marks**

Course Out comes(COs)/(POs)	**ZOO C5T**	**ZOO C5P**	**ZOO C6T**	**ZOO C6P**	**ZOO C7T**	**ZOO C7P**	**ZOO C8T**	**ZOO C8P**
I Core competency								X
II Critical thinking								X
III Analytical reasoning								X
IV Research skills								X
V Team work								X

Practical Content	**15**
1. **Water quality parameters assessment:** Collection of water sample, Dissolved Oxygen (O_2), Carbon dioxide (CO_2), Biological Oxygen Demand (BOD) Chemical Oxygen Demand (COD), chlorides, Hardness and salinity estimation in water. (Any four)	5
2. **Analysis of physico-chemical parameters of soil:** pH, soil moisture, soil temperature, organic matter in soil.	3
3. Analysis of air pollution: Air monitoring for particulate matter	1
4. Visit of pond and lakes: Collection and identification of fauna of selected ecosystems. Collection, preservation of phytoplanktons, zooplanktons and insect larva..	1
5. Demonstration of field equipments used in wildlife census: Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of cameras and lenses.	2
6. Identification wild animals: Wild animal's pugmarks, hoof marks scars, pellet groups, nest, antlers. Demonstration of field techniques for wild fauna.	1
7. Field visit to nearby National park/ Wildlife sanctuary/ any National laboratory at the end of semester is compulsory and the report of this is to be submitted along with practical record as a part of practical examination.	2

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

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Written Assessment /Presentation/Project/Term Papers/Seminars	10
Classroom Performance /Participation	10
Total	**25Marks**
Formative Assessment asper NEP guidelines are compulsory	

References	
1	Colinvaux, P. A.(1993) Ecology (2nd edition)Wiley, John and Sons, Inc.
2	Krebs,C. J.(2001)Ecology(6th edition) Benjamin Cummings.
3	Odum,E.P., (2008) Fundamentals of Ecology. IndianEdition. Brooks/Cole. (3rd Edition) BlackwellSci.
4	Kendeigh, FC.(1984) Ecology with Special Reference to Animal and Man. Prentice HallInc.
5	Caughley,G. and Sinclair, A.R.E.(1994)Wildlife Ecology and Management. Blackwell Science.
6	Woodroffe,R., Thirgood, S. and Rabinowitz,A. (2005) People and Wildlife, Conflict Or Co-existence? Cambridge University.
7	Bookhout,T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society,Allen Press.
8	Sutherland, W.J. (2000)The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
9	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

Following is the blue print of the question paper to be followed.

(As per BOS resolution dated 20.09.2022)

Scheme of Practical Examination

VI Semester

Paper VII: DSCC5 ZOO –P7; Evolutionary and Developmental Biology

(Practical Based on DSC**C5 ZOO –T7)**

Duration: 03 Hours **Max. Marks 25 M**

Practical Examination Scheme

I. Identify and comment on spotters A and B 3X2 = 06M
(Homologous/Analogous organ/Fossil Model) (Any Two)

II. Problem on Hardy-Weinberg Law- Chi square analysis (Problems related to evolution) 04 M

III. Identify and comment on slide C, D and E 3X4 = 12M
(Frog/Chick embryology slides)

IV. Identify and comment on F 03M
(Any one Human fossil)

Scheme of Valuation

I. Identification -01 M; Comments - 02M for each

II. Problem 04 M

III. Identification 01 M; Comment with diagram 03 M

IV. Identification 01M; Comments 02M

***

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)

VI Semester

Paper VIII: DSC**C5 ZOO –P8 :Environmental Biology Wildlife Management and Conservation**
(Practical Based on DSC**C5 ZOO –T8)**

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

I. Estimation of given Water sample for (any one) 12 M
(Dissolved O_2/CO_2/Hardness/Chloride)

II. Detect the Physico-chemical parameter of the soil (any one) 04 M
(pH, Moisture, Soil temperature, Organic matter)

III. Identify and Comment of the spot A & B 3X2 = 06 M
(Zooplanktons & Fauna of any ecosystem).

IV. Identify the spot C 03 M
(Binocular, Compass, Lens, Camera, GPS and Spotting Scope).

Scheme of Valuation

I. Principle and procedure -06 M
Conducting experiments – 04M
Result & Comment - 02M

II. Physical parameter - 03M
Comment - 01M

III. Identification - 01M
Comment - 02 M

IV. Identification - 01M
Comment with Application - 02M

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For B.Sc., III Year V and VI semesters

Following is the blue print of the question paper to be followed.

ZOOLOGY AND ANOTHER SUBJECT AS DOUBLE MAJORS IN THIRD YEAR

(As per BOS resolution dated 20.09.2022)

Sem	Disp.	Paper Code	Title	C	T	P	Ex	IA	E	T
V	DSC	**C5 ZOO -T5**	Non-chordates and Economic Zoology	4	4		2 hr	40	60	100
		C5 ZOO -P5	Practical Based on Zoo **C5 ZOO -T5**	2		4	3 hr	25	25	50
		C5 ZOO -T6	Chordates and Comparative Anatomy	4	4		2 hr	40	60	100
		C5 ZOO -P6	Practical Based on **C5 ZOO -T6**	2		4	3 hr	25	25	50
VI	DSC	**C5 ZOO -T7**	Evolutionary & Developmental Biology	4	4		2 hr	40	60	100
		C5 ZOO -P7	Practical Based on **C5 ZOO -T7**	2		4	3 hr	25	25	50
		C5 ZOO -T8	Environmental Biology,Wildlife Management & Conservation	4	4		2 hr	40	60	100
		C5 ZOO -P8	Practical Based on **C5 ZOO -T8**	2		4	3 hr	25	25	50

(C: credits; T: theory; P: Practical; Ex: Exam Duration; IA: Internal Assessment; E: Exam marks; T: Total)

Internship Allotment:

Since Double Majors Programme Being Followed in Third Year, Students Can Opt/choose Eighter Zoology Or Another Subject as Internship topic.