



**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)

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| 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, Maharani 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 (5th semester onwards). Teacher Education or Vocational courses may be chosen in place of Minor/s. Below listed are the various options students may choose from.
- One discipline, Two Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities.
- One discipline along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities.

AIMS AND OBJECTIVES OF UG PROGRAM IN ZOOLOGY

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

Weightage for assessments

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

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

Credit distribution for the course

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

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

SEMESTER WISE CURRICULUM STRUCTURE OF COURSES

[*Note: As per the BOS decision 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)	<ol style="list-style-type: none"> The structure and functions of animal cell, cell organelles, cell- cell interactions, process of reproduction leading to new organisms. The principles of inheritance, Mendel's laws and the deviations. 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)	<ol style="list-style-type: none"> Learn the systematics and biology of non-chordates through their adaptive features. Study the functional biology of non-chordates through their body organization. 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)	<ol style="list-style-type: none"> Acquaint the knowledge about basic procedure and methodology of integrated animal rearing. Students can start their own business i.e. self- employments. 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. 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 course	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	Vocational-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	<i>Any one of the below 4 choice</i> 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 7 th 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 cell organelles.
2. The chromatin structure and its location.
3. The basic principle of life, how a cell divides leading to the growth of an
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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Cytoskeleton: microtubules, microfilaments, intermediate filaments • Mitochondria: Structure, oxidative phosphorylation; electron transport system. • Endoplasmic reticulum: Structure, and function. • Peroxisome and Ribosome: structure and function 	
Unit II	14
Chapter 3. Nucleus and Chromatin Structure <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <i>Drosophila melanogaster</i>. • Sex-linked characteristics in humans and dosage compensation. 	
Chapter 6. Extensions of Mendelism, Genes and Environment <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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: <i>Trypanosoma</i>, <i>Giardia</i> and <i>Wuchereria</i>. 	

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 cell organelles.
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 new organisms.
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.
<ol style="list-style-type: none">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 <i>Allium cepa</i>.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 <i>Drosophila</i>/ insect mouth parts).8. Study of life cycles of <i>Drosophila</i> sp. (from Cultures or Photographs).9. Preparation of polytene chromosomes (<i>Chironomus</i> larva or <i>Drosophila</i> 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.in13. https://zoologysan.blogspot.com14. www.vlab.iitb.ac.in/vlab15. www.onlinelabs.in16. www.powershow.com17. 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, New Delhi.

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 laccultivation.
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: <ul style="list-style-type: none"> History and present status of sericulture in India Mulberry and non-mulberry species in Karnataka and India Mulberry cultivation Morphology and life cycle of <i>Bombyx mori</i> Silkworm rearing techniques: Processing of cocoon, reeling Silkworm diseases-pests and their control Chapter 2. Apiculture: <ul style="list-style-type: none"> Introduction and present status of apiculture Species of honey bees in India, life cycle of <i>Apis indica</i> 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: <ul style="list-style-type: none"> Dairy: Introduction to common dairy animals and techniques of dairy management Types, loose housing system and conventional barn system; advantages and limitations of dairy farming Establishment of dairy farm and choosing suitable dairy animals-cattle Cattle feeds, milk and milk products Cattle diseases Poultry: Types of breeds and their rearing methods Feed formulations for chicks Nutritive value of egg and meat Disease of poultry and control measures Chapter 4. Aquaculture: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Culture of fresh and marine water prawns. Preparation of farm. Preservation and processing of prawn, export of prawn. Chapter 7. Vermiculture: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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:

- Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
- Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
- Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, Kindle Edition.
- Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
- Yadav Manju (2003). Economic Zoology, Discovery Publishing House.
- Jabde Pradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
- Cherian & Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
- Sathe, T.V. Vermiculture and Organic farming.
- Bard, J (1986). Handbook of Tropical Aquaculture.
- Santhanam, R. A. Manual of Aquaculture.
- Zuka, R.I and Hamiyn (1971). Aquarium fishes and plants
- Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
- Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014
- Economics Of Aquaculture - Singh (R.K.P) - Danika Publishing Company 2003
- Applied and Economic Zoology (SWAYAM) web https://swayam.gov.in/nd2_ccc20_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 <i>Eisenia fetida</i> and <i>Eudrilus eugeniae</i> .	
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) — Vermes 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

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 Assessment Marks: 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: <ul style="list-style-type: none"> 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 α-amino acids; Essential and non-essential amino acids, Levels of organization in proteins; Simple and conjugate proteins. 	
Chapter 2. Enzyme Action and Regulation <ul style="list-style-type: none"> 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 K_m and V_{max}, Enzyme inhibition. Allosteric enzymes and their kinetics; Regulation of enzyme action. 	
Unit 2	14
Chapter 3. Metabolism of Carbohydrates and Lipids <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Catabolism of amino acids: Transamination, Deamination, Urea cycle, Nucleotides and vitamins Peptide linkages 	
Unit 3	14

Chapter 5. Digestion and Respiration in humans <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Components of blood and their functions; haemopoiesis • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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:

1. Nelson & Cox: Leininger 's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet & Voet: Biochemistry Vols I & 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, XI 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. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
10. Chatterjee CC Human Physiology Volume I & 2, 11th edition, CBS Publishers (2016).

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 Assessment Marks: 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.
 Know uniqueness of enzymes in animal body and their importance through enzyme kinetics.

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 determination of K_m and V_{max} .	15
8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.	
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.	
12. Estimation of Hemoglobin in human blood using Sahli's haemoglobinometer.	15
13. Counting of RBC in blood using Hemocytometer.	
14. Counting of WBC in blood using Hemocytometer.	
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.in www.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 1 & 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, XI 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. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume 1 & 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • <i>Fasciolopsis buski</i> • <i>Schistosoma haematobium</i> • <i>Taenia solium</i> • <i>Hymenolepis nana</i> Chapter 3. Parasitic Protists <ul style="list-style-type: none"> • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • <i>Entamoeba histolytica</i> • <i>Giardia intestinalis</i> • <i>Trypanosoma gambiense</i> • <i>Plasmodium vivax</i> 	14

Unit – 2	14
<p>Chapter 4. Parasitic Nematodes</p> <ul style="list-style-type: none"> • Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • <i>Ascaris lumbricoides</i> • <i>Ancylostoma duodenale</i> • <i>Wuchereria bancrofti</i> • <i>Trichinella spiralis</i> • Nematode plant interaction; Gall formation <p>Chapter 5. Parasitic Arthropods</p> <ul style="list-style-type: none"> • Biology, importance and control of • Ticks (Soft tick <i>Ornithodoros</i>, Hard tick <i>Ixodes</i>) • Mites (<i>Sarcoptes</i>) • Lice (<i>Pediculus</i>) • Flea (<i>Xenopsylla</i>) • Bug (<i>Cimex</i>) • Parasitoid (Wasps) <p>Chapter 6. Parasitic Vertebrates</p> <ul style="list-style-type: none"> • Cookicutter Shark • Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host 	
Unit – 3	14
<p>Chapter 7. Molecular diagnosis & clinical parasitology</p> <ul style="list-style-type: none"> • 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 <i>Giardia intestinalis</i>, <i>B. coli</i>, <i>E. histolytica</i>, <i>L. donovani</i>, Malarial parasite using ELISA, RIA • Counter Current Immuno-electrophoresis (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 & Distributors, 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 & Distributors, 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 2nd 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 <i>Bombyx mori</i> .	
7	Dissection of digestive system and silk glands of <i>Bombyx mori</i> .	
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			Theory	Practical		Theory	Practical
						Max.	MIN.	IA	Max.	MIN.	IA					
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
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

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

- II. 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

- III. 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

- IV. 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 F₁ 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

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) | <u>(05 marks)</u> |
| | 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 | <u>(05 marks)</u> |
| 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.

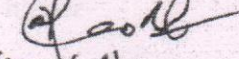
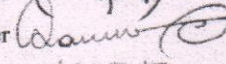
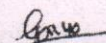
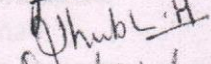
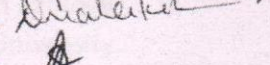

A meeting of the BOS (UG) in Zoology was held at Dept. of Life Science, Central College on Friday, the 26th August 2022 during 10.00 to 4.00 pm to reach the final consensus on the given agenda.

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:

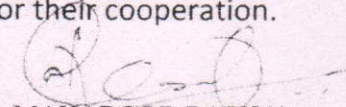
1. The proposed syllabus for BSc in Zoology theory and Practical and Scheme of examination for III and IV semesters were scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.
2. The panel of Examiners (Both internal and external) for B.Sc. 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. Shobha M. Bhat Associate Professor in Zoology, Maharani Cluster University , Bangalore. | Member | (co-opted) |
| 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 | B.S.C. E. T. H. |

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

FOREWORD

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)	<ol style="list-style-type: none"> The structure and functions of animal cell, cell organelles, cell- cell interactions, process of reproduction leading to new organisms. The principles of inheritance, Mendel's laws and the deviations. 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)	<ol style="list-style-type: none"> Learn the systematics and biology of non-chordates through their adaptive features. Study the functional biology of non-chordates through their body organization. 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)	<ol style="list-style-type: none"> Acquaint the knowledge about basic procedure and methodology of integrated animal rearing. Students can start their own business i.e. self- employments. 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)	<ol style="list-style-type: none"> In depth understanding of structure of biomolecules like proteins, lipids and carbohydrates. The thermodynamics of enzyme catalyzed reactions. 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)	<ol style="list-style-type: none"> 1. Learn the systematics and biology of Chordates through their adaptive features. 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)	<ol style="list-style-type: none"> 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 course	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	Vocational-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	<i>Any one of the below 4 choice</i> 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 7 th 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: 40	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 <ul style="list-style-type: none"> • Fine structure of gene (Cistron, Recon, Muton) • RNA polymerases - types and functions • Transcription in prokaryotes and eukaryotes 	8
Chapter 2: Process of Translation <ul style="list-style-type: none"> • Genetic code and its salient features • Translation in prokaryotes and eukaryotes 	6
Unit II	14
Chapter 3. Regulation of Gene Expression-I <ul style="list-style-type: none"> • Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon (repressible) in <i>E. coli</i> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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

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 <ul style="list-style-type: none">● 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 <ul style="list-style-type: none">● 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 & Analysis 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. Snedecor 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

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	Course 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 biology techniques.

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

Semester: III Zoology**Open Elective Course Content**

Course Title: ENDOCRINOLOGY Course Code: OEC5ZOOT3	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 student should be able to:

Differentiate among endocrine, paracrine and autocrine systems.

1. Describe the different classes and chemical structures of hormones.
2. Identify the glands, organs, tissues and cells that synthesize and secrete hormones, hormone precursors and associated compounds.
3. Identify and discuss the integration of the endocrine system in general with focus on specific interactions.
4. Explain the consequences of under- and overproduction of hormones.

Course Content

Content	Hrs.
Unit I	14
Chapter 1. About Endocrine glands <ul style="list-style-type: none"> • Endocrine glands and classification of hormones. • Characteristics and Transport of Hormones. Chapter 2. Hypothalamus -Hypothesis <ul style="list-style-type: none"> • Hypothalamus as a neuroendocrine organ • Pituitary – Structure and functions • Chemical nature, mode of action, and functions. Pituitary disorders. Chapter 3. Pineal gland <ul style="list-style-type: none"> • Structure and functions of Pineal gland. • Hypo- and hyperactive states of the gland. 	
Unit II	14
Chapter 4. Thyroid and parathyroid <ul style="list-style-type: none"> • Histological structure of the glands. • Chemical nature, mode of action, and functions of the hormones. • Hypo-and hyperactive states of the glands. Chapter 5. Adrenal cortex and medulla – <ul style="list-style-type: none"> • Histological structure of the gland. Chemical nature, and functions • Hypo- and hyperactive states of the gland. Chapter 6. Prostaglandins.	
Unit – III	14

Chapter 7: Pancreas: <ul style="list-style-type: none"> Pancreatic islets - histological structure. Chemical nature, and function. Hormonal control of blood sugar. Hyperinsulinism and diabetes mellitus. Chapter 8: Gastro-intestinal hormones – <ul style="list-style-type: none"> Functions and regulation of secretion of the hormones. Chapter 9: Different types of physiological rhythms – <ul style="list-style-type: none"> Ultradian, circadian, infradian. Different zeitgebers and their relation with circadian clock Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep-wakefulness cycle. Time keeping genes. Jet-lag and shift work. 	
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Text Books & Suggested Readings:

1. William's Text Book of Endocrinology Larsen et al.: An Imprint of Elsevier.
2. Endocrinology, Mac E. Hadley, Pearson Education.
3. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
4. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
5. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
6. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
7. The Physiology of Reproduction, Vols.I & II, by E. Knobil and J.D. Neil. Raven Press.
8. Guyton and Hall. Textbook of Medical Physiology. 13th Edition.
9. Histology: A Text and Atlas. Sixth Edition. Ross & Pawlina. Lippincott Williams & Wilkins.
10. Vertebrate Endocrinology by David O. Norris.

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

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar.

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

1. Demonstrate comprehensive understanding of the structure, function and development of the human body as related to endocrinology physiology.
2. Demonstrate elementary understanding of the clinical applications of physiology.
3. Critically evaluate the impact of the recent information on the genesis of current concepts related to various topics of physiology

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

Open Elective Course Content

Semester: IV Zoology

Course Title: Animal Behaviour Course Code: OEC5ZOOT4	Course Credits: 3
Total Contact Hours: 42	Duration of ESA: 3 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

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

1. Examine and critically to evaluate the emergence of ideas that have shaped how we observe and collect data on animal behaviour.
2. Understand the main historical ideas that underpin animal behaviour theory
3. Critically review hypotheses to explain animal behaviour
4. Understand different methods for collecting data on animal behaviour
5. Have advanced their written and oral presentation skills.

Course Content

Content	42Hrs
Unit – 1	
Chapter 1. Introduction to Animal Behaviour <ul style="list-style-type: none"> • Brief contributions of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen. • Proximate and ultimate causes of behaviour. Chapter 2. Patterns of Behaviour <ul style="list-style-type: none"> • Stereotyped Behaviors - Orientation and Reflex. • Individual Behavioural patterns: Instinct and Learned Behaviour • Associative learning, classical and operant conditioning, Habituation, Imprinting. 	14
Unit – 2	14
Chapter 3. Social Behaviour <ul style="list-style-type: none"> • Social organization in Termites and Honey bees • Social behaviour: Altruism. • Conflict behaviour. Chapter 4. Sexual Behaviour <ul style="list-style-type: none"> • Sexual dimorphism, Mate choice in peacock. • Intra-sexual selection (male rivalry in red deer). • Kinship theory: Relatedness & inclusive fitness. • Parental care in fishes (Nest Building & cost benefit) 	
Unit – 3	14
Chapter 5. Chronobiology <ul style="list-style-type: none"> • Brief historical developments in chronobiology. • Adaptive significance of biological clocks. • Biological rhythms. Chapter 6. Communications in animals <ul style="list-style-type: none"> • Bioluminescence in deep sea fishes and insects • Territoriality in Monkeys and Dogs • Role of pheromones in animal communication- Insects and Vertebrates. • Communication in Honey bees (Waggle dance). 	

Suggested Readings:

1. Animal Behaviour by Drickamar.
2. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
3. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
4. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
5. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Baren's and Noble Inc. New York, USA
6. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag,

Germany.

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

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

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			Theory	Practical		Theory	Practical
						Max.	MIN.	IA	Max.	MIN.	IA					
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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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 | 08M |
| (PCR/PAGE/Restriction enzyme kit/FASTA/BLAST/Database) | |

TOTAL Marks 25M

Following is the blue print of the question paper to be followed.
(As per BOS resolution dated 20.09.2022)
BSC III Semester Zoology Open Elective (OE)

ENDOCRINOLOGY

Time: 2.5hours

Max.Marks:60

Instructions to Candidates:

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

PART-A

- I. Choose the correct answer from the given options below/ Write the correct answer to fill in the blank in each sentence. (30×1=30)

Here total 30 questions-(10 from each Unit) to be answered.

PART-B

- II. Answer any ten of the following in one word or one sentence each: (10×1=10)

Here out of 12 questions (4 from each Unit) **ten** have to be answered.

PART-C

- III. Answer any ten of the following: (10×2=20)

Here out of 12 questions (4 from each Unit) **ten** have to be answered.

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

BSC IV Semester Zoology Open Elective (OE)
ANIMAL BEHAVIOUR

Time: 2.5 hrs

Max.Marks:60

Instructions to Candidates:

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

PART-A

- I. Choose the correct answer from the given options below/ Write the correct answer to fill in the blank in each sentence. (30×1=30)**

Here total 30 questions-(10 from each Unit) to be answered.

PART-B

- II. Answer any ten of the following in one word or one sentence each: (10×1=10)**

Here out of 12 questions (4 from each Unit) **ten** have to be answered.

PART-C

- III. Answer any ten of the following: (10×2=20)**

Here out of 12 questions (4 from each Unit) **ten** have to be answered.