



**Department of Higher education Karnataka State Higher
Education Council National Education Policy -2020**

**Proposed Model Curriculum for Undergraduate Programme in
Zoology**

in

All state Universities and Colleges in Karnataka

For the year 2022-2023

Submitted by

Zoology / Genetics Subject

Committee

NEP2020

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| | | |
|----|---------------------------------------------------------------------------------------------------------------------------|----------|
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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 way 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 came 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. Mainstreaming 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 exit 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. K. Vijaykumar
Chairman
Zoology/Genetics Faculty Committee

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 OE1 Open 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, |

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|--------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 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) | | | | | | |

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| 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) | | | | | | |

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| 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, |

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| 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, |

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| 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, |

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| 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, |

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|-----------------------------------------------------|-----------------------------------------------------------|--|--------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 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"> Centrifugation: Principles, types, and applications (High speed and Ultracentrifugation) Chromatography : Principle and applications of: TLC, HPLC and GC | 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 Dideoxy 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):

| |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>At the end of the course the student should be able to:</p> <ol style="list-style-type: none"> 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 |
| <p>Chapter 1: Principles of Gene Manipulation</p> <ul style="list-style-type: none"> ● Recombinant DNA Technology: Introduction, steps involved. ● Restriction Enzymes and Ligases and Nucleic acid modifying enzyme. ● Gene cloning Vector: Concept of plasmids-pBR322, Lamda phage vectors, cosmids ● Gene transfer techniques (Direct and indirect). ● Screening and selection of recombinant colonies | 07 |
| <p>Chapter 2: Applications of Genetic Engineering</p> <ul style="list-style-type: none"> ● Transgenic animals (Transgenic cow, Transgenic Fish); Transgenic plants (cry protein); Gene silencing (Knock out and Knock in mouse). ● Production of Human Recombinant insulin and ● Hybridoma technology: Synthesis and applications of Monoclonal antibodies ● Gene Therapy (SCID) ● Biosensors and its applications | 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 Ummunity 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:

- Primrose & Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
- Hartl & Jones. Genetics: principles & Analysis of Genes & Genomes. Jones & Bartlett (1998).
- Sambrook *et al.* Molecular Cloning Vols I, II, III. CSHL (2001).
- Primrose. Molecular Biotechnology. Panima (2001).
- Clark & Switzer. Experimental Biochemistry. Freeman (2000)
- Sudbery. Human Molecular Genetics. Prentice-Hall (2002).
- Wilson. Clinical Genetics-A Short Course, Wiley (2000).
- Pasternak. An Introduction to Molecular Human Genetics. Fitzgerald (2000).
- 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)
14. Genetic engineering: Sandhya Mitra BITS, Pilani
15. Principles of Biostatistics Khan and Khanam
16. Transgenic animals: Ranga

Web Sources:

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

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

Semester: IV

Course Lab Content

| | |
|----------------------------------------------------------------------------|---------------------------------------|
| Course Title: Gene Technology, Immunology and Computational Biology | Course Credits: 02 |
| Course Type: Minor Discipline Core Practical, L-T-P: 0-0-4 | Course Code: DSCC5ZOO4 |
| 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 | Hours |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <ol style="list-style-type: none">1. Calculate the mean, median, mode and standard deviation (Measurement of pre and post clitellar lengths (with suitable examples).2. Measure the height and weight of all students in the class and apply statistical measures.3. Determination of ABO Blood group and Rh factor.4. To study Restriction enzyme digestion using teaching kits (Demonstration only).5. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only).6. Demonstration of agarose gel electrophoresis for detection of DNA.7. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.8. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (https://youtube/mCiCiO0cfbg)9. To learn nucleotide sequence database.10. To learn sequence alignment: Pairwise alignment (Protein/ DNA). | |

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 classifications of hormones. • Characteristics and Transport of Hormones. • Chapter 2. Hypothalamus-Hypophysis <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:

- Pancreatic islets - histological structure. Chemical nature, and function. Hormonal control of blood sugar.
- Hyperinsulinism and diabetes mellitus.

Chapter 8: Gastro-intestinal hormones –

- Functions and regulation of secretion of the hormones.

Chapter 9: Different types of Rhythms –

- 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.

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 |
| Model Syllabus Authors: | |

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 | |
| 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) | 14 |
| Unit – 3 | |
| 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) | 14 |

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 (PCR/PAGE/Restriction enzyme kit/FASTA/BLAST/Database) | 08M |

TOTAL Marks 25M

Model Question Paper
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. **Answer any five of the following** (5X2=10)

1. Mention four examples for endocrine glands
2. What are the neuroendocrine cells of hypothalamus?
3. List out any four functions of melatonin
4. What are the different types of biological rhythms?
5. Mention the 3 hormones of adrenal cortex.
6. What are the types of cells found in parathyroid gland? Mention one function.
7. How does jet lag and shift work contribute to sleep deprivation?

PART- B

II. **Answer any five of the following** (5X4=20)

1. Explain the functions and regulations of cholecystokinin.
2. What are time keeping genes? How does it influence sleep?
3. Explain the histological structure of islets of Langerhans.
4. Write a note on prostaglandins.
5. Mention the different types of cells of adenohypophysis with its secretions.
6. Write a note on hypersecretion of parathyroid gland.

PART- C

III. **Answer any three of the following** (3X10=30)

1. What are hormones? Classify the hormones based on chemical nature.
2. Explain the hormonal control of blood sugar.
3. Discuss the functions of thyroid gland. Add a note on its hypersecretion.
4. Explain how zeitgebers affect time signals and reset sleep.

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Model Question Paper
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. Answer any five of the following

(5X2=10)

1. Define habituation with example.
2. Mention the two dances of honey bees.
3. What is bioluminescent organism? Give example
4. Mention the four types of altruism.
5. List any two difference between classical & Operant conditioning.
6. List any four contribution of Ivan Pavlov.
7. What is meant by stereotyped behavior? Name any two types.

PART- B

II. Answer any five of the following

(5X4=20)

1. " Termites are social insects". Justify.
2. Explain imprinting with an example of geese.
3. Write a note on mate choice in Peacock.
4. Explain kinship theory with reference inclusive fitness.
5. Explain territoriality in monkeys.
6. Write a note on parental offspring conflict.

PART- C

III. Answer any three of the following

(3X10=30)

1. What are Pheromones? Explain its role in animal communication example.
2. Explain Social organization in termites.
3. Explain parental care in fishes.
4. Briefly explain the historical development in Chronobiology.