RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS

As per the Choice Based Credit System (CBCS) designed in accordance with Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020

For

Bachelor of Science (Basic/Hons) Zoology

w.e.f.

Academic Year 2021-22 and onwards

RANI CHANNAMMA UNIVERSITY, BELAGAVI
BSc (Basic/Hons) Zoology program-2021-22

BoS Committee-NEP-BSc (Hons) Zoology

S.No.	Name & Address	Designation
1	Prof. K. Kantharaju Chairman & Professor, Dept. of Chemistry RCUB	**Chairman**
2	Shri. J. M. Meti, KPS College Vijayapur .	**Member**
3	Dr. M. A. Ghodesawar, Anjuman College Vijayapur .	**Member**
4	Dr. N. Birsal, KLES-BKASC College, Chikkodi.	**Co-opted Members**
5	Dr. D.M. Patil, GPPorwal AC&VVSS college, Sindagi-28	**Co-opted Members**

PREAMBLE

The learning outcomes-based curriculum framework for B.Sc.Degree in Zoology is structured to offer a broad outline within which a Zoology program could be developed. The Zoology course is upgraded keeping in mind the aspirations of students, changing nature of the subject as well as the learning environment. Courses within Zoology have been revisited to incorporate recent advancements, techniques to upgrade the skills of learners. The new structure is expected to enhance the level of understanding among students and maintain the standard of Zoology degrees/program. Effort has been made to integrate use of recent technology and use of MOOCs to assist teaching-learning process among students.

This framework permits the review of graduate attributes, qualification descriptors, program learning outcomes and course-level learning outcomes periodically. The framework offers flexibility and innovation in syllabi designing and in methods adopted for teaching- learning process and learning assessment. The major objective is to elevate the subject knowledge of the students, making them critical thinkers and able to solve problems and issues related to Zoology logically and efficiently. Overall, this course has been modified to upgrade skills related to biological science and provide our students a competitive edge in securing a career in academia, industry, pharmaceutical research and development in private as well as public sectors. This course serves as plethora of opportunities in different field's right from classical to applied Zoology.

Zoology has been studied in an integrated and cross-disciplinary manner with a comprehensive understanding of all living systems, their relationship with the ecosystem and their application. The framework imbibes a Learning Outcome-based Curriculum Framework (LOCF) for its entire Under Graduate program in Zoology.

A comprehensive understanding and appreciation of the organism differences through ICT tools, MOOCs and well-designed hands on practical exposures along with the field work and if the same principle is followed to understand different phyla through the ladder of evolution and compare cardinal features for classification involving both morphological and molecular tools, along with associated field and lab work, the final product would be better trained without rote learning. Syllabi required are to impart and assess the quality of critical thinking, analytical and scientific reasoning, reflective thinking, information and digital literacy, and problem-solving capacity.

Aim of program deals with the study of animal kingdom specially the structural diversity, biology, embryology, evolution, habits and distribution of animals, both living and extinct. As it covers a fascinating range of topics, the modern zoologists need to have insight into many disciplines.

The Zoology courses designed in terms of concepts, mechanisms, biological designs & functions and evolutionary significance. The students should do the dissertation/ project work under practical of different courses, wherever possible.

Program Learning Outcome

Students enrolled in B.Sc. (Hons.) degree program in Zoology will study and acquire complete knowledge of disciplinary as well as allied biological sciences. At the end of graduation, they should possess expertise which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries.

Students should be able to identify, classify and differentiate diverse chordates and non-chordates based on their morphological, anatomical and systemic organization. They will also be able to describe economic, ecological and medical significance of various animals in human life. This will create a curiosity and awareness among them to explore the animal diversity and take up wild life photography or wild life exploration as a career option. The procedural knowledge about identifying and classifying animals will provide students professional advantages in teaching, research and taxonomist jobs in various government organizations; including Zoological Survey of India and National Parks/Sanctuaries.

Acquired practical skills in biotechnology, biostatistics, bioinformatics and molecular biology can be used to pursue career as a scientist in drug development industry in India or abroad. Our students will be acquiring basic experimental skills in various tecniques in the fields of genetics; molecular biology; biotechnology; qualitative and quantitative microscopy; enzymology andanalytical biochemistry. These methodologies will provide an extra edge to our students, who wish to undertake higher studies. In-depth knowledge and understanding bout comparative anatomy and developmental biology of various biological systems; and learning about the

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Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Biotechnology Major& One Minor Discipline Scheme for the Four Years Chemistry B.Sc. Undergraduate Honors Programme with effect from 2021-22

SEMESTER-I										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	2
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	2
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1C1ZOO1L	Cytology, Genetics and Infectious Diseases	40	60	100	4	-	-	4	2
	21BSC1C1ZOO1P	Cell Biology and Genetics	25	25	50	-	-	4	2	4
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
SEC1	21BSC1S1CS1	Digital Fluency	25	25	50	0/2	-	4/0	2	4/2
VBC1	21BSC1V1PE1	Physical Education-Yoga	25	-	25	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC1	21BSC1O1ZOO1	Economic Zoology	40	60	100	3	-	-	3	2
Total Marks				**700**		**Semester Credits**			**25**	

SEMESTER-II											
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2ZOO2L	Biochemistry and Physiology	40	60	100	4	-	-	4	2
	21BSC2C2ZOO2P	Physiological, Biochemical & Hematology	25	25	50	-	-	4	2	4
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
AECC1	21BSC2AE1ES2	Environmental Studies	20	30	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BSC2O2ZOO2	Parasitology	40	60	100	3	-	-	3	2
Total Marks				**700**		**Semester Credits**			**25**	

Note: *All skill enhancement course (SEC) syllabus and title should be selected time to time notice from the university and/ or NEP committee accordingly.*

SECOND YEAR; SEMESTER-III										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3C3ZOO3L	Molecular Biology, Bioinstrumentation & Biotechniques	40	60	100	4	-	-	4	2
	21BSC3C3ZOO3P	Bioinstrumentation & Molecular Biology	25	25	50	-	-	4	2	4
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
SEC2	21BSC3S2AI	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	25	25	50	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	25	50	-	-	2	1	-
OEC3	21BSC3O3ZOO3		40	60	100	3	-	-	3	2
Total Marks			**700**			**Semester Credits**			**25**	

SEMESTER-IV										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	-
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C4ZOO4L	Gene Technology, Immunology and Computational Biology	40	60	100	4	-	-	4	2
	21BSC4C4ZOO4P	Genetic Engineering and Counseling	25	25	50	-	-	4	2	2
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	2
AECC 2	21BSC4AE1ES2	Constitution of India	20	30	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/R &R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC4	21BSC4O3ZOO4	Multimedia & Animation	40	60	100	3	-	-	3	2
Total Marks			**700**			**Semester Credits**			**25**	

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Zoology as Major Discipline										
DSC5	21BSC5C5ZOO5L	Non-Chordates and Economic Zoology	40	60	100	3	-	-	3	2
	21BSC5C5ZOO5P	Non-Chordate and Economic Zoology	25	25	50	-	-	4	2	4
DSC6	21BSC5C6ZOO6L	Chordates and Comparative Anatomy	40	60	100	3	-	-	3	2
	21BSC5C6ZOO6P	Chordate(Virtual Dissection), Comparative Anatomy	25	25	50	-	-	4	2	4
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	4
VC1	21BSC5VC1ZOO		40	60	100	3	-	-	3	2
VBC 9	21BSC5V5PE5	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC 10	21BSC5V6NC4	NCC/NSS/R &R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BSC5S3CS	Cyber security	25	25	50	1	-	2	2	2
Total Marks					**650**	**Semester Credits**			**22**	

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/wee**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Zoology as Major Discipline										
DSC7	21BSC6C7ZOO7L	Evolutionary and Developmental Biology	40	60	100	3	-	-	3	2
	21BSC6C7ZOO7P	Evolutionary and Developmental Biology	25	25	50	-	-	4	2	4
DSC8	21BSC6C8ZOO8L	Environmental Biology and Wildlife Management	40	60	100	3	-	-	3	2
	21BSC6C8ZOO8P	Environmental Biology, Wildlife Management and conservation	25	25	50	-	-	4	2	4
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	4
VC2	21BSC6VC2HT	Health Care Technologies	40	60	100	3	-	-	3	2
	21BSC6VC2DM	Digital Marketing								
INT1	21BSC6 INT1L	Internship	25	50	75	-	-	2	2	2
VBC1	21BSC6V5PE5	Physical Education - Sports	25	-	25	-	-	2	1	-
VBC2	21BSC6V6NC4	NCC/NSS /R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BSC6S4PC	Profession Communication	25	25	50	1	-	2	2	2
Total Marks					**700**	**Semester Credits**			**24**	
Total Marks for BSC Program					**4450**	**Total Credits for**			**146**	

		BSC Program	

- Internship between 5th and 6th semester with 3-4 weeks

Zoology Subject as a Minor Discipline

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC5 As a Minor Subject	21BSC5C5ZOO5L	Non-Chordates and Economic Zoology	40	60	100	3	-	-	3	2
	21BSC5C5ZOO5P	Non-Chordate and Economic Zoology	25	25	50	-	-	4	2	4

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC6 As a Minor Subject	21BSC6C6ZOO7L	Evolutionary and Developmental Biology	40	60	100	3	-	-	3	2
	21BSC6C6ZOO7P	Evolutionary and Developmental Biology	25	25	50	-	-	4	2	4

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of B.Sc. Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).
5. A candidate shall choose one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. **OEC: For non- computer science students. Computer Science students have to opt for OEC from departments other than major and minor disciplines.**

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.

8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit, &Language Urdu
7. Code 1: Course in that semester.
8. Zoo: Zoology

Note: *All skill enhancement course (SEC) syllabus and title should be selected time to time notice from the university and/ or NEP committee accordingly.*

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**15**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05

Total	**25**

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY
Department of ZOOLOGY

Duration: 2hr ***I Semester B.Sc (****Zooogy)*

Sub: **Code:** **Maximum Marks: 60**

a. Answer any SIX Questions from Question 1 b. Answer any Three each Questions from Question 2, 3, 4 and 5

Q.No.1.	**Answer any SIX Questions (Two question from Each Unit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**2X6=12**
Q.No.2.	**(Should cover Entire Unit-I)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.3.	**(Should cover Entire Unit-II)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.5.	**(Should cover Entire Unit-IV)** **a.** **b.** **c.** **d.**	**4X3=12**

SYLLABUS

Semester I

Year	I	**Course Code:** 21BSC1C1ZOO1L	**Credits**	04
Sem.	1	**Course Title: Cytology, Genetics and Infectious Diseases**	**Hours**	56

Unit No.	**Course Content**	**Hours**
Unit I	**Structure and Function of Cell Organelles I in Animal cell** • Plasma membrane: chemical structure—lipids and proteins • Endomembrane system: protein targeting and sorting, transport, endocytosis and exocytosis **Structure and Function of Cell Organelles II in Animal Cell** • Cytoskeleton: microtubules, microfilaments, intermediate filaments • Mitochondria: Structure, oxidative phosphorylation; electron transport system Peroxisome and Ribosome: structure and function	14
Unit II	**Nucleus and Chromatin Structure** • Structure and function of nucleus in eukaryotes • Chemical structure and base composition of DNA and RNA • Structure of chromosomes • Types of DNA and RNA **Cell cycle, Cell Division and Cell Signaling** • Cell division: mitosis and meiosis • Introduction to Cell cycle and its regulation, apoptosis • Signal transduction: intracellular 11 signaling and cell surface receptors, via G-protein linked receptors • Cell-cell interaction: cell adhesion molecules, cellular junctions	14
Unit III	**Mendelism and Sex Determination** • Basic principles of heredity: Mendel ‘s laws- monohybrid cross and hybrid cross • Complete and Incomplete Dominance • Genetic Sex-Determining Systems, Environmental Sex Determination, Sex Determination and mechanism in *Drosophilamelanogaster*. • Sex-linked characteristics in humans and dosage compensation **Extensions of Mendelism, Genes and Environment** • Extensions of Mendelism: Multiple Alleles, Gene Interaction. • The Interaction Between Sex and Heredity: Sex-Influenced and Sex-Limited Characteristics • Cytoplasmic Inheritance, Genetic Maternal Effects. Interaction between Genes and Environment: Environmental Effects on Gene Expression, Inheritance of Continuous Characteristics.	14

Unit IV	**Human Chromosomes and Patterns of Inheritance** • Patterns of inheritance: autosomal dominance, autosomal recessive, X-linked recessive, X-linked dominant. • Chromosomal anomalies: Structural and numerical aberrations with examples. • Human karyotyping .. **Infectious Diseases** • Introduction to pathogenic organisms: viruses, bacteria, fungi, protozoa and worms. Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of common parasites: *Trypanosoma, Giardia and Wuchereria*	14

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, 13thEdition. 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 / TermPapers/Seminar

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination/Test	10
Written Assignment/Presentation/Project / Term Papers/Seminar	15
Class performance/Participation	05
Total	30

Zoology -Lab Course Content

Semester - I

Course Title: Cell Biology &Cytogenetics	Course Credits:**2**
Course Code**:** 21BSC1C1ZOO1P	L-T-P per week: 0-0-4
Total Contact Hours**: 56**	Duration of ESA:4 Hours
Formative Assessment Marks: **15**	Summative AssessmentMarks:**35**

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	**CCP1**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**
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.

Lab Course Content

List of labs to be conducted	56 hrs
1. Understanding of simple and compound microscopes. 2. To study different cell types such as buccal epithelial cells, neurons, striated muscle cells using 3. Methylene blue/any suitable stain (virtual/ slaughtered tissue). 3. To study the different stages of Mitosis in root tip of *Allium cepa*. 4. To study the different stages of Meiosis in grasshopper testis (virtual). 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 beingstudied in theory) permanent microslides. 7. To learn the procedures of preparation of temporary and permanent stained slides, with available mounting material. 8. Study of mutant phenotypes of *Drosophila* sp. (from Cultures or Photographs). 9. Preparation of polytene chromosomes (Chironomus larva or Drosophila larva). 10. Preparation of human karyotype and study the chromosomal structural and numerical aberrations from the pictures provided. (Virtual/optional).	

Suggested Readings:

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

Pedagogy: Practical Examination format

Question	content	Marks
I	Preparation	05
II	Karyotype	06
III	Identification	14
IV	Vivo	05
V	Record Book	05
	Total	35

OPEN-ELECTIVE SYLLABUS :

Year	I	**Course Code:** 21BSC1O1ZOO1	**Credits**	03
Sem.	1	**Course Title: Economic Zoology**	**Hours**	42

Unit No.	**Course Content**	**Hours**
Unit I	**1. Sericulture:** • History and present status of sericulture in India • Mulberry and non-mulberry species in Karnataka and India • Mulberry cultivation • Morphology and life cycle of *Bombyxmori* • Silkworm rearing techniques: Processing of cocoon, reeling • Silkworm diseases and pest control **2. Apiculture:** • Introduction and present status of apiculture • Species of honey bees in India, life cycle of *Apisindica* • 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	14
Unit II	**3. Live Stock Management:** **Dairy:** • Introduction to common dairy animals and techniques of dairy management • Types, loose housing system and conventional barn system; advantages and limitations of dairy farming • Establishment of dairy farm and choosing suitable dairy animals-cattle • Cattle feeds, milk and milk products • Cattle diseases **Poultry:** • Types of breeds and their rearing methods • Feed formulations for chicks • Nutritive value of egg and meat • Disease of poultry and control measures **4. Aquaculture:** • Aquaculture in India: An overview and present status and scope of aquaculture Types of aquacultures: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture	14
Unit III	**5. Fish culture:** • Common fishes used for culture.	14

	• 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 **6. Prawn culture:** • Culture of fresh and marine water prawns. • Preparation of farm. • Preservation and processing of prawn, export of prawn. **7. Vermiculture:** • Scope of vermiculture. • Types of earthworms. • Habit categories - epigeic, endogeic and anecic; indigenous and exotic species. • Methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of vermicompost. • Advantages of vermicomposting. • Diseases and pests of earthworms. **8.Lac Culture:** • History of lac and its organization, lac production in India. • Life cycle, host plants and strains of lac insect. • Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac. Lac composition, processing, products, uses	

Text Books: Suggested Readings:

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, KindleEdition.

7. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
8. YadavManju (2003). Economic Zoology, Discovery Publishing House.
9. JabdePradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Cherian &Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
11. Sathe, T.V. Vermiculture and Organic farming.
12. Bard. J (1986). Handbook of Tropical Aquaculture.
13. Santhanam, R. A. Manual of Aquaculture.
14. Zuka. R.1 and Hamiyn (1971). Aquarium fishes and plants
15. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
16. Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014
17. Economics of Aquaculture - Singh (R.K.P) - Danika Publishing Company 2003
18. Applied and Economic Zoology (SWAYAM) web

https://swayam.gov.in/nd2_cec20_ge23/preview Course Books published in English and Kannada may be prescribed by the Universities and College

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

SKILL ENHANCEMENT COURSE IN CHEMISTRY

Title of the Course: SEC: Course code: 21BSC1E1CS1
Paper name: Digital Fluency

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	02	01	11	---	---	10	10
Practical		02	22	2	25	15	40
				Total	25	25	50

Semester: II

Year	I	Course Code: 21BSC2C2ZOO2L	Credits	04
Sem.	2	Course Title: Biochemistry and Physiology	Hours	56

Unit No.	Course Content	Hours
Unit I	**Structure and Function of Biomolecules:** • Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates). • Lipids (saturated and unsaturated Fatty acids, Tri-acylglycerols, 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. **Metabolism of Carbohydrates and Lipids** • Metabolism of Carbohydrates: glycolysis, citricacid cycle, gluconeogenesis, • phosphate pentose pathway Glycogenolysis and Glycogenesis Lipids- Biosynthesis of palmiticacid; Ketogenesis, • β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbonatoms	14
Unit II	**Metabolism of Carbohydrates and Lipids** • Metabolism of Carbohydrates: glycolysis, citricacid cycle, gluconeogenesis, • phosphate pentose pathway Glycogenolysis and Glycogenesis Lipids- Biosynthesis of palmiticacid; Ketogenesis, • β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbonatoms **Metabolism of Proteins and Nucleotides** • Catabolism of amino acids: Transamination, Deamination, Ureacycle, Nucleotides and vitamins Peptide linkages	14
Unit III	**Digestion and Respiration in humans** • Structural organization and functions of gastrointestinal tract and associated glands. • Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Physiology of trachea and Lung. • Mechanism of respiration, Pulmonary	14

	ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it; **Circulation and Excretion in humans** • Components of blood and their functions; hemopoiesis • 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	**Nervous System and Endocrinology in humans** • Structure of neuron, resting membrane potential(RMP) • Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Types of synapse Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal **Muscular System in humans** Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus.	14

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

Semester II: Zoology Course Lab Content

Course Title/Code: Biochemistry and Physiology	Course Credits: **2**
Course Code: 21BSC2C2ZOO2P	L-T-P per week: 0-0-4
Total Contact Hours**: 56**	Duration of ESA: 4 Hours
Formative AssessmentMarks: **15**	Summative AssessmentMarks:**35**

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	**CC P1**	**CC P2**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**	**CC**
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	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 -Km and Vmax. 8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.	15
10. Estimation of Hemoglobin in human blood using Sahli'shaemoglobinometer. 11. Counting of RBC in blood using Hemocytometer. 12. Counting of WBC in blood using Hemocytometer. 13. Differential staining of human blood corpuscles using Leishman stain. 14. Recording of blood glucose level by using glucometer.	15
Virtual Labs (Suggestive sites) https://www.vlab.co.in https://zoologysan.blogspot.com www.vlab.iitb.ac.in/vlab https://vlab.amrita.edu https://sites.dartmouth.edu www.onlinelabs.in	06

Text Books

1. Nelson & Cox: Lehininger's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, Xl Edition, Hercourt Asia PTE Ltd. /W.B.Saunders Company. (2006).
6. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Edition John

Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (20I6).

Web References: Mammalian Physiology– www.biopac.com

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

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. Nature of proteins and nurture of animal body.
9. Role of lipids in structural and functional organization of body.

Pedagogy: Practical Examination formet

Question	**content**	**Marks**
I	Qualitative test/Separation	09
II	Quantitative test/Differential count	09
III	Estimation/Counting	09
IV	Vivo	03
V	Record Book	05
	Total	**35**

OPEN-ELECTIVE SYLLABUS:

Year	I	**Course Code:** 21BSC2O2ZOO2 **Course Title: Parasitology**	**Credits**	03
Sem	II		**Hours**	42

Unit No.	**Course Content**	**Hours**
Unit I	**1. General Concepts** • Introduction, Parasites, parasitoids, host, zoonosis • Origin and evolution of parasites • Basic concept of Parasitism, symbiosis, phoresis, commensalisms and mutualism • Host-parasite interactions and adaptations • Life cycle of human parasites • Occurance, mode of infection and prophylaxis **2. Parasitic Platyhelminthes** Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Fasciolopsisbuski* • *Schistosomahaematobium* • *Taeniasolium* • *Hymenolepis nana* **3. Parasitic Protists** Study of morphology, life cycle, pathogenicity, prophylaxis and control *measures* of • *Entamoeba histolytica* • *Giardia intestinalis* • *Trypanosomagambiense* *Plasmodium vivax*	14
Unit II	**4.Parasitic Nematodes** Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Ascarislumbricoides* • *Ancylostomaduodenale* • *Wuchereriabancrofti* • *Trichinellaspiralis* • Nematode plant interaction ; Gall formation **5. Parasitic Arthropods** Biology, importance and control of • Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*) • Mites (*Sarcoptes*) • Lice (*Pediculus*) • Flea (*Xenopsylla*) • Bug (*Cimex*) • Parasitoid (Beetles) **6. Parasitic Vertebrates** • Cookicutter Shark • Hood Mocking bird and	14

	Vampire bat and their parasitic behavior and effect on host	
Unit III	**7.Molecular diagnosis & clinical parasitology** • General concept of molecular diagnosis for parasitic infection • Advantages and disadvantages of molecular diagnosis • Fundamental techniques used in molecular diagnosis of endoparasites • Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules like G.intestinalis, B. coli, E. histolytica, L. donovani, Malarial parasite using • ELISA, RIA • Counter Current Immunoelectrophoresis (CCI) Complement Fixation Test (CFT) PCR, DNA, RNA probe	14

Suggested Readings:

1. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors.
2. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea&Febiger.
3. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group.
4. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
5 Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
5. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd.
6. Gunn, A. and Pitt, S.J. (2012). Parasitology: an Integrated Approach. Wiley Blackwell.
7. Noble, E. R. and G.A.Noble (1982) Parasitology: The biology of animal parasites. V th Edition, Lea &Febiger.
8. Paniker, C.K.J., Ghosh, S. [Ed} (2013). Paniker‘s Text Book of Medical Parasitology. Jaypee, New Delhi.
9. Parija,S.C. Text book of medical parasitology,protozoology&helminthology (Textand color Atlas),II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
10. Roberts, L.S and Janovy, J. (2009). Smith & Robert‘s Foundation of Parasitology. 8th. Edn. McGraw Bogitsh, B. J. and Cheng, T. C. (2000). Human Parasitology. 2nd Ed. Academic Press, New York.
11. Chandler, A. C. and Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley and Sons Inc.
12. Cheng, T. C. (1986). General Parasitology. 2nd ed. Academic Press, Inc. Orlando.U.S.A.
13. Schmidt, G. D. (1989). Essentials of Parasitology. Wm. C. Brown Publishers (Indian print1990, Universal Book Stall).
14. John Hyde (1996) Molecular Parasitology Open University Press.

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