BSc I SEMESTER ZOOLOGY CORE COURSE CONTENT
DSC 1: CYTOLOGY, GENETICS AND INFECTIOUS DISEASES

Course Title: **CYTOLOGY, GENETICS AND INFECTIOUS DISEASES**	Course Credits: **4**
Total Contact Hours: **56**	**Course Code: ZOODSCT-1.1**
Teaching hours/Week:4 Hours	**Max. Marks:100 (SEE - 60+I.A – 40)**

Course outcomes (Cos)

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

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

Semester I- Zoology Core Course I Content:

Content	Hours
Unit I	**14**
Chapter 1. Structure and Function of Cell Organelles I in Animal cell **Chapter 2** Plasma membrane: chemical structure—lipids and proteins **Chapter 3** Endomembrane system: protein targeting and sorting, transport, endocytosis and exocytosis	
Chapter 2. Structure and Function of Cell Organelles II in Animal Cell **Unit III** **14** • Cytoskeleton: microtubules, microfilaments, intermediate filaments • Mitochondria: Structure, oxidative phosphorylation; electron transport system • Peroxisome and Ribosome: structure and function	
Unit II	**14**
Chapter 3. Nucleus and Chromatin Structure • Structure and function of nucleus in eukaryotes • Chemical structure and base composition of DNA and RNA • DNA supercoiling, chromatin organization, structure of chromosomes • Types of DNA and RNA	
Chapter 4. Cell cycle, Cell Division and Cell Signaling • Cell division: mitosis and meiosis • Introduction to Cell cycle and its regulation, apoptosis • Signal transduction: intracellular 11 signaling and cell surface receptors, via G-protein linked receptors • Cell-cell interaction: cell adhesion molecules, cellular junctions	

Chapter 5. Mendelism and Sex Determination • Basic principles of heredity: Mendel's laws- monohybrid cross and hybrid cross • Complete and Incomplete Dominance • Penetrance and expressivity • Genetic Sex-Determining Systems, Environmental Sex Determination, Sex Determination and mechanism in *Drosophilamelanogaster*. • Sex-linked characteristics in humans and dosage compensation	
Chapter 6. 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.	
Unit IV	**14**
Chapter 7. Human Chromosomes and Patterns of Inheritance • Patterns of inheritance: autosomal dominance, autosomal recessive, X-linked recessive, X-linked dominant. • Chromosomal anomalies: Structural and numerical aberrations with examples. • Human karyotyping and Pedigree analysis.	
Chapter 8. Infectious Diseases • Introduction to 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.*	

Text Books for Reference:

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

BSc I SEMESTER ZOOLOGY PRACTICAL CONTENT
DSC 1: CYTOLOGY, GENETICS AND INFECTIOUS DISEASES

Course Title: **CYTOLOGY, GENETICS AND INFECTIOUS DISEASES**	Course Credits: **4**
Total Contact Hours: **56**	**Course Code: ZOODSCP-1.1**
Teaching hours/Week:4 Hours	**Max. Marks:50 (SEE - 25+I.A – 25)**

Course outcomes (Cos0

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.

DSC 1: CYTOLOGY, GENETICS AND INFECTIOUS DISEASES LAB

List of Experiments:

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).
11. To prepare family pedigrees.
12. https://www.vlab.co.in
13. https://zoologysan.blogspot.com
14. www.vlab.iitb.ac.in/vlab
15. www.onlinelabs.in
16. www.powershow.com
17. https://vlab.amrita.eduhttps://sites.dartmouth.edu/

Text Book for Reference:

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

B.Sc. I SEMESTER OPEN ELECTIVE COURSE CONTENT

OE I: ECONOMIC ZOOLOGY

Course Title: **Economic Zoology** Course Code: **ZOOOET-1.1**	Course Credits: **03**
Total Contact Hours**: 42**	Max. Marks: 100 (SEE – 60 + I.A – 40)
Teaching Hours/Week: 03 hours	

Course Outcomes (Cos):

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

1. Gain knowledge about silkworms rearing and their products.
2. Gain knowledge in Bee keeping equipment and apiary management.
3. Acquaint knowledge on dairy animal management, the breeds and diseases of cattle and learn the testing of egg and milk quality.
4. Acquaint knowledge about the culture techniques of fish and poultry.
5. Acquaint the knowledge about basic procedure and methodology of vermiculture.
6. Learn various concepts of lac cultivation.

SEMESTER I
OPEN ELECTIVE COURSE I CONTENT

Content	Hrs
Unit I	**14**
Chapter 1. Sericulture: • History and present status of sericulture in India • Mulberry and non-mulberry species in Karnataka and India • Mulberry cultivation • Morphology and life cycle of *Bombyxmori* • Silkworm rearing techniques: Processing of cocoon, reeling • Silkworm diseases and pest control **Chapter 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	

Unit II	14
Chapter 3. Live Stock Management: • **Dairy:**Introduction to common dairy animals and techniques of dairy management • Types, loose housing system and conventional barn system; advantages and limitations of dairy farming • Establishment of dairy farm and choosing suitable dairy animals-cattle • Cattle feeds, milk and milk products • Cattle diseases • **Poultry:** Types of breeds and their rearing methods • Feed formulations for chicks • Nutritive value of egg and meat • Disease of poultry and control measures **Chapter 4. Aquaculture:** • Aquaculture in India: An overview and present status and scope of aquaculture • Types of aquaculture: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture	
Unit – 3	**14**
Chapter 5. Fish culture: • Common fishes used for culture. • Fishing crafts and gears. • Ornamental fish culture: Fresh water ornamental fishes- biology, breeding techniques • Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. control of snail and algal growth. • Modern techniques of fish seed production **Chapter 6. Prawn culture:** • Culture of fresh and marine water prawns. • Preparation of farm. • Preservation and processing of prawn, export of prawn. **Chapter 7. Vermiculture:** • Scope of vermiculture. • Types of earthworms. • Habit categories - epigeic, endogeic and anecic; indigenous and exotic species. Methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of vermicompost. • Advantages of vermicomposting. • Diseases and pests of earthworms. **Chapter 8.Lac Culture:** • History of lac and its organization, lac production in India. • Life cycle, host plants and strains of lac insect. • Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac. • Lac composition, processing, products, uses and their pests.	

Text Books for Reference:

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

24.

B.Sc. II SEMESTER ZOOLOGY CORE COURSE CONTENT
DSC 2: BIOCHEMISTRY AND PHYSIOLOGY

Course Title: **BIOCHEMISTRY AND PHYSIOLOGY**	Course Credits: **4**
Total Contact Hours**: 56**	**Course Code: ZOODSCT-2.1**
Teaching hours/Week:4 Hours	**Max. Marks:100** **(SEE - 60+I.A – 40)**

Course Outcome (Cos):

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

Semester II-Zoology Core Course II Content:

Content	Hours
Unit I	**14**
Chapter 1. Structure and Function of Biomolecules: • Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates). • Lipids (saturated and unsaturated Fatty acids, Tri-acylglycerols, Phospho lipids, Glycolipids and Steroids) • Structure, Classification and General Properties of a-amino acids; Essential and non-essential amino acids, Levels of organization in proteins; Simple and conjugate proteins.	

Chapter 2. Enzyme Action and Regulation • Nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action. • Isozymes; Mechanism of enzyme action • Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions ; Equation of Michaela‘s -Mendon, Concept of Km and V max, Enzyme inhibition • Allosteric enzymes and their kinetics; Regulation of enzyme action.	
Unit 2	**14**
Chapter 3. Metabolism of Carbohydrates and Lipids • Metabolism of Carbohydrates: glycolysis, 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	

Chapter 4. Metabolism of Proteins and Nucleotides • Catabolism of amino acids: Transamination, Deamination, Ureacycle, Nucleotides and vitamins • Peptide linkages	
Unit 3	**14**
Chapter 5. Digestion and Respiration in humans • Structural organization and functions of gastrointestinal tract and associated glands. • Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Physiology of trachea and Lung. • Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it; • Control of respiration.	
Chapter 6. Circulation and Excretion in humans • Components of blood and their functions; 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	**14**
Chapter 7. Nervous System and Endocrinology in humans • Structure of neuron, resting membrane potential(RMP) • Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Types of synapse • Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal; hormones secreted by them. • Classification of hormones; Mechanism of Hormone action.	
Chapter 8. Muscular System in humans • Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus	

Suggested Readings:

I. Nelson & Cox: Leininger‘s Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper‘s Illustrated Biochemistry: McGraw Hill (2003)
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).

Proposed Syllabus

B.Sc. Zoology for III and IV Semester

Under

NEP-2020

CHOICE BASED CREDIT SYSTEM

With effect from academic year 2022-23

DEPARTMENT OF ZOOLOGY

GOVERNMENT COLLEGE, KALABURAGI – 585 105

(AN AUTONOMOUS INSTITUTION)

GOVERNMENT COLLEGE, KALABURAGI (AN AUTONOMOUS INSTITUTION) - 585105

DEPARTMENT OF ZOOLOGY

Program Structure And Proposed Scheme of Teaching and Evaluation For B.Sc.(Basic & Hons) III&IV Semester (with Effect from Academic Year -2022-23 and onwards)

Semester- III

Sl. No.	Course Code	Title Of The Course	Category Of The Courses	Teaching Hours Per Week (L+T+P)	Exam Duration	SEE	IA	Total Marks	Credits
1	B.Sc-3.1	Molecular Biology Bioinstrumentation on & Techniques in Biology	ZOODSCT - 3.1	4+0+0	2 hrs	60	40	100	4
2	B.Sc-3.2	Practical-III	ZOODSCP -3.1	0+0+4	2 hrs	25	25	50	2
3	B.Sc-3.5	Endocrinology	ZOOOET - 3.1	3+0+0	2 hrs	60	40	100	3
Total For III Semester						145	105	250	9

Semester- IV

Sl. No.	Course Code	Title Of The Course	Category Of The Courses	Teaching Hours Per Week (L+T+P)	Exam Duration	SEE	IA	Total Marks	Credits
1	B.Sc-4.1	Gene Technology, Immunology and Computational Biology	ZOODSCT – 4.1	4+0+0	2 hrs	60	40	100	4
2	B.Sc-4.2	Practical-IV	ZOODSCP – 4.1	0+0+4	2 hrs	25	25	50	2
3	B.Sc-4.5	Animal Behavior	ZOOOET- 4.1	3+0+0	2 hrs	60	40	100	3
Total For IV Semester						145	105	250	

Note:- 1) Zoo- Zoology; DSC- Discipline Core; OE- Open Elective; T- Theory/ P- Practical
L= Lecture, T= Tutorial, P= Practical

2) Semester Main Examinations and Internal Examinations Shall be conducted as per the Regulations / Directions of the Examination branch of GCAK.

Government of Karnataka
Department of Collegiate and Technical Education
GOVERNMENT COLLEGE KALABURAGI (AN AUTONOMOUS INSTITUTION)-585105.
Phone: 08472-245064 (Re-Accredited by NACC with "A" Grade) www.gcak.ac.in

Ref No.: GCK (AI)/BOS (UG)/2022-23/ Date: **16.11.2022.**

To,
The Dean (UG)
Academic section.
Govt. College (Autonomous), Kalaburagi.

Sir,

Subject: Submission of BOS approved BSc III & IV Semester Zoology Syllabus under NEP Scheme – 2020.

Reference: 1. UGC Revised Guidelines for Autonomous Colleges dt. : 19.01.2018
2. Registrar, GUK Letter No. ಗುವಿಕ/ವಿಮವಿ/ಬಿಒಎಸ್/2017-18/2547 Dated 24.01.2018
3. Resolution of the DC meeting held on 17.10.2022

With reference to the above cited subject and reference, I am submitting BOS approved BSc III & IV Semester Zoology Syllabus under NEP Scheme – 2020. We have proceeded with Department council meeting and finally discussed in BOS meeting and as per discussion and suggestions draft syllabus prepared and it approved by BOS along with model question paper for theory exam (DSET & OET) and as well as for practical exam (DSCP).

Thanking you.

Yours faithfully

(BOS Chairman)
HOD
DEPT OF STUDIES
AND RESEARCH IN ZOOLOGY
GOVT. COLLEGE, KALABURAGI

Enclosures: 1. BOS proceedings.
2. Office order constituting BOS.
3. BOS approved syllabus.

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DEPARTMENT OF ZOOLOGY

Proceedings of the Board of Studies (UG) in Zoology

The meeting of the Board of Studies (UG) in Zoology for the year 2022-23 was held on 15-11-2022 at 11 am, in the Department of Zoology, Government College, Kalaburagi. The committee discussed on draft syllabus (revision/new) of undergraduate courses of Zoology of B. Sc. IIIrd & IVth semester and approved as below.

Item-I: To frame and approve the syllabus

The member thoroughly discussed over the papers to be taught and their contents and resolved to have the following courses.

Program Name	Course Code	Course Name	Revision /New course	% of Revision in case of revision	Remarks
B.Sc. III SEMESTER					
B.Sc.	ZOODSCT - 3.1	Molecular Biology Bioinstrumentation on & Techniques in Biology	New Course	100	
	ZOODSCP -3.1	Practical-III	New Course	100	
	ZOOOET - 3.1	Endocrinology	New Course	100	
B.Sc. IV SEMESTER					
B.Sc.	ZOODSCT – 4.1	Gene Technology, Immunology and Computational Biology	New Course	100	
	ZOODSCP – 4.1	Practical-IV	New Course	100	
	ZOOOET- 4.1	Animal Behavior	New Course	100	

The committee also approved the syllabus of all the above courses.

Item-II : To approve the pattern of question paper for DSCT,OET and DSCP

It is resolved to adopt the following pattern of question papers

Question Paper Pattern for Semester end theory examination (Final) for B. Sc. III / IV Semesters DSCT and OET (NEP).

Duration: 2 hrs **Maximum Marks: 60**

Instructions: **Attempt All Sections**

		SECTION-A	
Q I.		**Answer Any FIVE of the following**	**5 X 2 = 10**
	1		
	2		
	3		
	4		
	5		
	6		
	7		
		SECTION-B	
Q II.		**Answer Any FOUR of the following**	**4 X 5 = 20**
	8		
	9		
	10		
	11		
	12		
	13		
		SECTION-C	
Q III.		**Answer Any THREE of the following**	**3 X 10 =30**
	14		
	15		
	16		
	17		
	18		

NOTE: While Selecting the Questions, All The units in The Syllabus Must Be Given Equal Weightage.

Question Paper Pattern for Semester end Practical examination (Final) for B. Sc.III /IV Semesters DSCP (NEP).

Time: 02 hrs **Max. Marks: 25**

SI. NO:	**EXPERIMENTS:**	**MARKS**
1	Major Experiment	**10**
2	Minor Experiment	**05**
3	Identify and Give The Working Principle of The Spotters A & B	**05**
4	Viva	**05**
	TOTAL MARKS	**25**

The Committee also approved the list of board of examiners.

The following members were present in the BOS meeting.

Sl. No.	Name of the BOS Members present in the meeting		Designation	Signature
01	Dr. SomanathReddy C. Patil	Chairman	Associate Professor & HOD	
02	Dr. Shankerappa S Hatti	Member	Associate Professor & Principal	
03	Dr. Meenakshi K .C	Member	Assistant Professor	
04	Mr. Dinesh Mehtre	Member	Assistant Professor	
05	Dr. K. Vijaykumar	University Nominee	Professor & Chairman, Former VC, GUK	15.11.2022
06	Dr. Zeba Parveen	External	Associate Professor	15/11/2022
07	Dr. Manjunath K	External	Assistant Professor	
08	Hanmanth Vidyasagar Kodli	External Member Representing Industry	Quality Control Officer	
09	Pavan Mohanrao	Alumni	Assistant Professor	

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Ref No.: GCK (AI)/BOS (UG)/2022-23/ Date : **20.10.2022.**

OFFICE ORDER

Subject: **Appointment of Members of Board of Studies (UG)**

Reference: **1. UGC Revised Guidelines for Autonomous Colleges dt. : 19.01.2018**
2. Registrar, GUK Letter No. [illegible]/2017-18/2547 Dated 24.01.2018
3. Resolution of the DC meeting held on 17.10.2022

Advert to the cited subject and references, the Board of Studies (UG) in Zoology has been constituted as shown below.

Board of Studies (UG) in ZOOLOGY

Sl. No.	Name of the Members	Designation	Address with Phone No & e-mail	Appointed as
01	3 Dr. Somanathreddy C Patil.	Associate Professor & HOD	Department of Zoology, Government College (Autonomous) Kalaburagi -585105 9448405795 somanath.sairam@gmail.com	Chairman
02	Dr. Shankerappa S Hatti	Associate Professor& Principal	Department of Zoology, Government College(Autonomous) Kalaburagi) -585105 9980391964 hattishankerappa@gmail.com	Member
03	Dr. Meenakshi K C	Assistant Professor	Department of Zoology, Government College (Autonomous) Kalaburagi -585105 8073815288 meenakshichengate@gmail.com	Member
04	1 Dinesh Mehtre	Assistant Professor	Department of Zoology, Government College(Autonomous) Kalaburagi -585105 8892261922 mehtredinesh143@gmail.com	Member
05	Dr. K. Vijaykumar 2	Chairman & Professor, Former VC GUK	Department of Zoology Gulbarga University Kalaburagi-58506 9480060508 katepaga@rediffmail.com	University Nominee

① Nagbhushan Reddy. — Addl Prof — SB College Sdk

② Shaik Fameeda — Asst Prof Dept of Zoology LBN University Kal
9535820809
fehameeda.patel2012@gmail.com.

06	Dr. Zeba Parveen	Associate Professor & Principal	Department of Zoology Bi Bi Raza Womens College Kalaburagi 9632223786 zebame786@gmail.com	External Member (Other than Parent University)
07	Dr. Manjunath K	Assistant Professor	Department of Zoology LVD Degree College Raichur 8884951701 manjunath2007@rediffmail.com	External Member (Other than Parent University)
08	(5) Hanmanth Vidyasagar Kodli	Quality Control Officer	Kalaburagi Cement Private Limited Chatrasala Unit. Tq: Chincholi Dist: Kalaburagi 9964577754 hvrudnur@gmail.com	External Member Representing Industry/Corporate Sector/Allied area
09	Pavan Mohanrao	Assistant Professor	Department of Zoology SB College of Science, Kalaburagi 7349324506 mkpavan2995@gmail.com	Alumni

The term of nominated members shall be 03 years from the date of this Order.

Copy to:

1. Chairman, Board of Studies (UG) in ZOOLOGY
2. All the members of the BOS in ZOOLOGY
3. Academic Dean (UG) Govt. College (Autonomous), Kalaburagi
4. Office Copy.

(6) Ashok prathan Assistant prof Dept of zoology GCAK

Prathanashok32@gmail.com

(4) → Kaneez Fatima Women Bi Bi Raza

B.Sc. III SEMESTER ZOOLOGY CORE COURSE CONTENT
DSC 3: Molecular Biology, Bioinstrumentation &Techniques in Biology

Course Title: **Molecular Biology, Bioinstrumentation & Techniques in Biology**	Course Code: **ZOODSCT- 3.1**
Total Contact hours: **56**	Course Credits: **4**
Teaching Hours/Week :**4 Hours**	**Max. Marks: 100 (SEE-60 + I.A – 40)**

Course Outcomes (COs)

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

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

Semester III- Zoology
Core Course III Content:

	Content	Hours
	Unit I	**14**
Chapter 1	**Process of Transcription** • Fine structure of gene (Cistron, Recon, Muton) • RNA polymerases - types and functions • Transcription in prokaryotes and eukaryotes	**8**
Chapter 2	**Process of Translation** • Genetic code and its salient features • Translation in prokaryotes an	**6**
	Unit II	**14**
Chapter 3	**Regulation of gene expression-1** • Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon (repressible) in E. coli • Regulation of gene expression in eukaryotes - Role of chromatin (euchromatin and heterochromatin) in gene expression • Post-transcriptional modification: capping, splicing, polyadenylation • Concept of RNA editing (mRNA), gene silencing, and RNAi	**9**

Chapter 4	**Regulation of gene expression-II** • Post-translational modifications: purpose, advantages, and significance; glycosylation, methylation, phosphorylation, and acetylation. • Intracellular protein degradation (lysosomalautophagy and ubiquitinproteosomepathway	**5**
	Unit III	**14**
Chapter 5	**Microscopy** • Principles and applications of Light microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM)	**9**
Chapter 6	**Centrifugation and Chromatography** • 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** • Colorimetry and Spectrophotometry: Beer-Lambert's law, Absorption spectrum, UV-VL Spectrophotometer. • pH meter, measurement of pH • Principle, applications and safety measures of Radio-tracer techniques - Autoradiography.	**6**
Chapter 8	**Molecular Techniques** • Principle and applications of Agarose gel-electrophoresis, SDS-PAGE, DNA Sequencing(Sanger's Dideoxy method) • PCR, DNA Fingerprinting, ELISA, Southern Blotting and Western Blotting.	**8**

Text Books for Reference :

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).

B.Sc. III SEMESTER ZOOLOGY PRACTICAL CONTENT

DSC 3: Molecular Biology, Bioinstrumentation & Techniques in Biology

Course Title: **Molecular Biology, Bioinstrumentation & Techniques in Biology**	Course Code: **ZOODSCP- 3.1**
Total Contact hours: **56**	Course Credits: **2**
Teaching Hours/Week :**4 Hours**	**Max. Marks: 50 (SEE-25 + I.A – 25)**

Course Outcomes (COs):

At the end of the course, students will 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.

DSC 3: MOLECULAR BIOLOGY, BIOINSTRUMENTATION & TECHNIQUES IN BIOLOGY LAB

List of Experiments

1. To study the principle and applications of simple, compound and binocular microscopes.
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.
3. To prepare Buffer solutions (Phosphate, Citrate, Tris-HCl buffer)
4. To estimate amount of RNA by Orcinol method.
5. Demonstration of differential centrifugation to fractionate components in a given mixture.
6. To estimate amount of protein by Lowry's method.
7. To identify different unknown amino acids using ascending paper chromatography.
8. Extraction of DNA from the given animal tissue sample.
9. To estimate amount of DNA by di-phenylamine (DPA) method.

Text Books for Reference :

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell, 4thedition.NewYork: 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)

B.Sc. III SEMESTER OPEN ELECTIVE COURSE CONTENT

OE 3: Endocrinology

Course Title: **Endocrinology**	Course Code: **ZOOOET-3.1**
Total Contact hours: **42**	Course Credits: **03**
Teaching Hours/Week :**3 Hours**	**Max. Marks: 100** **(SEE-60 + I.A – 40)**

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

Semester III
Open Elective Course III Content:

	Content	Hrs.
	Unit I	**14**
Chapter 1	**About Endocrine Gland** • Endocrine glands and classifications of hormones. • Characteristics and Transport of Hormones.	
Chapter 2	**Hypothalamus-Hyphophysis** •Hypothalamus as a neuroendocrine organ. • Pituitary – Structure and functions. • Chemical nature, mode of action, and functions. • Pituitary disorder.	
Chapter 3	**Pineal gland** • Structure and functions of Pineal gland. • Hypo- and hyperactive states of the gland.	

	Unit II	**14**
Chapter 4	**Thyroid and Parathyroid** • 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** • 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 islet-histological structure. Chemical nature, and function. Hormonal control of blood sugar. • Hyperinsulinism and diabetes mellitus.	
Chapter 8	**Gastro-intestinal hormones** • Function and regulation of secretion of the hormones.	
Chapter 9	**Different types of Rhythms** • Ulradian, circadian, infradian. Different zeitgebers and their relation with circardian clock • Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep-wakefulness cycle. Time keeping genes. Jet-lag and Shift work.	

Text Books for Reference :

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.
5. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
6. The Physiology of Reproduction, Vols.I& II, by E. Knobil and J.D. Neil. Raven Press.
7. Guyton and Hall. Textbook of Medical Physiology. 13th Edition.
8. Histology: A Text and Atlas. Sixth Edition. Ross &Pawlina. Lippincott Williams & Wilkins.
9. Vertebrate Endocrinology by David

B.Sc. IV SEMESTER ZOOLOGY CORE COURSE CONTENT
DSC 4: Gene Technology Immunology & Computational Biology

Course Title: **Gene Technology Immunology and Computational Biology**	Course code: **ZOODSCT - 4.1**
Total Contact hours: **56**	Course Credits: **4**
Teaching Hours/Week :**4 Hours**	**Max. Marks: 100 (SEE-60 + I.A – 40)**

Course Outcomes (COs):

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

1. Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA technology.
2. An understanding on application of genetic engineering techniques in basic and applied experimental biology.
3. To acquire a fundamental working knowledge of the basic principles of immunology.
4. To understand how these principles, apply to the process of immune function.
5. Use, and interpret results of, the principal methods of statistical inference and design; helps to communicate the results of statistical analyses accurately and effectively; helps in usage of appropriate tool of statistical software.

B.Sc. IV SEMESTER ZOOLOGY CORE COURSE CONTENT
DSC 4: Gene Technology Immunology & Computational Biology

Course Title: **Gene Technology Immunology and Computational Biology**	Course code: **ZOODSCT - 4.1**
Total Contact hours: **56**	Course Credits: **4**
Teaching Hours/Week :**4 Hours**	**Max. Marks: 100 (SEE-60 + I.A – 40)**

Course Outcomes (COs):

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

1. Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA technology.
2. An understanding on application of genetic engineering techniques in basic and applied experimental biology.
3. To acquire a fundamental working knowledge of the basic principles of immunology.
4. To understand how these principles, apply to the process of immune function.
5. Use, and interpret results of, the principal methods of statistical inference and design; helps to communicate the results of statistical analyses accurately and effectively; helps in usage of appropriate tool of statistical software.

Semester IV- Zoology
Core Course IV Content:

	Content	Hours
	Unit-I	**14**
Chapter 1	**Principles of Gene Manipulation** • 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**
Chapter 2	**Applications of Genetic Engineering** • 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** • 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** • Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). • B and T cell epitopes. • Structure of IgG and functions of different classes of immunoglobulins. • Major his to compatibility complex - Structure of MHC I & II.	**07**

	Unit -III	**14**
Chapter 5	**Clinical Immunology** • Immunity against diseases of viral, bacterial and protozoan infections. • Vaccines: Types and Uses - Immunization schedule for children. Transplantation immunology: Transplantation of organ- Types, graft rejection and Immuno-suppressors	07
Chapter 6	**Bioinformatics** • Databases: Sequence and structural • Sequence analysis (homology): Pairwise and Multiple Sequence alignment- BLAST, CLUSTALW, Sequence alignment- FASTA. Scope and applications of Bioinformatics.	07
	Unit -IV	**14**
Chapter 7	**Biostatistics I** • Measures of central tendency: Mean, Median, Mode. • Data summarizing: Frequency distribution, Graphical presentation - bar diagram, pie diagram, histogram. • Elementary idea of probability and its applications	07
Chapter 8	**Biostatistics II** • Measures of dispersion: Range, Standard Deviation, Variance. • Correlation and Regression. • Tests of significance: F-test, ANOVA, t-test and Chi square test	07

Text Books for Reference :

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

B.Sc. IV SEMESTER ZOOLOGY PRACTICAL CONTENT

DSC4: Gene Technology Immunology and Computational Biology

Course Title: **Gene Technology Immunology and Computational Biology**	Course Code: **ZOODSCP- 4.1**
Total Contact hours: **56**	Course Credits: **2**
Teaching Hours / Week :**4 Hours**	**Max. Marks: 50** **(SEE-25 + I.A – 25)**

Course Outcomes (COs):

At the end of the course, students will 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.

DSC4: GENE TECHNOLOGY IMMUNOLOGY AND COMPUTATIONAL BIOLOGY LAB

List of Experiments

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).

Text Books for Reference :

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

B.Sc. IV SEMESTER OPEN ELECTIVE COURSE CONTENT

OE 4: Animal Behavior

Course Title: **Animal Behavior**	Course Code: **ZOOOET-4.1**
Total Contact hours: **42**	Course Credits: **03**
Teaching Hours/Week :**3 Hours**	**Max. Marks: 100** **(SEE-60 + I.A – 40)**

Course Outcomes (COs):

At the end of the course, 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 behavior.
2. Understand the main historical ideas that underpin animal behavior theory
3. Critically review hypotheses to explain animal behavior
4. Understand different methods for collecting data on animal behavior
5. Have advanced their written and oral presentation skills.

Semester IV
Open Elective Course IV Content:

	Content	Hours
	Unit-I	**14**
Chapter 1	**Introduction to Animal Behavior** • Origin and history of Ethology; • Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, • Proximate and ultimate causes of behavior,	
Chapter 2	**Patterns of Behavior** • Stereotyped Behaviours (Orientation, Reflexes); • Individual Behavioural patterns; Instinct vs. Learned Behaviour; • Associative learning, classical and operant conditioning, Habituation, Imprinting.	
	Unit-II	**14**
Chapter 3	**Social Behavior** • Social Organization in Termites and Honey Bees • Social Behavior – Altruism • Conflict behaviour.	
Chapter 4	**Sexual Behavior** • Sexual dimorphism, Mate choice in peacock. • Intra-sexual selection (male rivalry in red deer). • Kinship theory: Relatedness & inclusive fitness. • Parental care in fishes (Nest Building & cost benefit)	

	Unit-III	14
	Chronobiology	
Chapter 5	• Brief historical developments in chronobiology. • Adaptive significance of biological clocks. • Biological Rhythms	
	Communications in animals	
Chapter 6	• 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)	

Text Books for Reference:

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 Barens and Noble Inc. New York, USA.
6. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/59 Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music) /BVA / BTTM / BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS) / BBA & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. in Zoology

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SYLLABUS

With Effect from 2023-24

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM V & VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM V
INTERNSHIP COURSE FOR SEM VI

AS PER N E P - 2020

Karnatak University, Dharwad

B.Sc. in Zoology

Effective from 2023-24

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instruction hour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**035 ZOO 011**	Non-Chordates and Economic Zoology	04hrs	56	02 hrs	40	60	100	04
	DSCC-10	Practical	**035 ZOO 012**	Non-Chordates and Economic Zoology	04 hrs	56	03 hrs	25	25	50	02
	DSCC-11	Theory	**035 ZOO 013**	Chordates and Comparative Anatomy	04hrs	56	02 hrs	40	60	100	04
	DSCC-12	Practical	**035 ZOO 014**	Chordates and Comparative Anatomy	04 hrs	56	03 hrs	25	25	50	02
	Other subject										04
	Other subject										02
	Other subject										04
	Other subject										02
	SEC-3	Practical	**035 ZOO 061**	The Bee Keeping	04hrs	56	03 hrs	25	25	50	02
	Total										**26**
VI	DSCC-13	Theory	**036 ZOO 011**	Evolutionary and Developmental Biology	04hrs	56	02 hrs	40	60	100	04
	DSCC-4	Practical	**036 ZOO 012**	Evolutionary and Developmental Biology	04 hrs	56	03 hrs	25	25	50	02
	DSCC-15	Theory	**036 ZOO 013**	Environmental Biology, Wildlife Management and Conservation	04hrs	56	02 hrs	40	60	100	04
	DSCC-16	Practical	**036 ZOO 014**	Environmental Biology, Wildlife Management and Conservation	04 hrs	56	03 hrs	25	25	50	02
	Other subject										04
	Other subject										02
	Other subject										04
	Other subject										02
	Internship-1	Practical	**036 ZOO 091**	Internship				50	0	50	02
	Total										**26**

B.Sc. in Zoology

V Semester

W. E. F. 2023-24

B.Sc. Semester – V

Discipline Specific Course (DSCC)-9

Course Title: Non-Chordates and Economic Zoology (Theory)
Course Code: 035 ZOO 011

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-9	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO1: Understand the evolutionary history and diversity of non-chordates

CO2: Study the external and internal characters of non-chordates

CO3: Expose type, structural and functional organization of non-chordates

CO4: Group the animals on the basis of their morphological characteristics.

CO 5: Understand the economic importance of non-chordates

Units	**DSCC-9:** **Course Title: Non-Chordates and Economic Zoology –Theory (Code: 035 ZOO 011)**	**56.hrs/ sem**
Unit- I	**Phylum Protozoa:** General characters and classification up to classes; Locomotory organelles and locomotion in Protozoa. Type study: Paramecium (Morphology and Reproduction) **Phylum Porifera:** General characters and classification upto classes; Canal System in poriferans. Type study: Sycon (Morphology and Reproduction) **Phylum Cnidaria:** General characters and classification upto classes; Polymorphism in Physalia. Type study: Obelia (Morphology and Reproduction) **Ctenophora:** Salient features	14
Unit- II	**Phylum Platyhelminthes:** General characters and classification upto classes; Parasitic adaptations (morphological and physiological). Type study: Taenia (Tape worm)- (Morphology and Reproduction) **Phylum Nemathelminthes:** General characters and classification upto classes; Transmission, pathogenicity and preventive measures of Ascarisasis. Type study: Ascaris (Round worm)- (Morphology and Reproduction) **Phylum Annelida** General characters and classification upto classes; Metamerism in Annelida and external morphology of Leech. Type study: Hirudinaria (Leech) - (Morphology and Reproduction)	14
Unit- III	**Phylum Arthropoda** General characters and classification upto classes; Metamorphosis in Insects and economic importance insects. Type study: Palaemon (Prawn) - (Morphology, Appendages, Nervous system and Reproduction). **Phylum Mollusca** General characters and classification upto classes; Torsion in gastropods, Pearl	14

	formation. Type study: Pila (morphology, shell, respiration, nervous system and Reproduction) **Phylum Echinodermata** General characters and classification upto classes; Water-vascular system in Asteroidea. Type study: Pentacerous (Morphology and Reproduction)	
Unit- IV	**Economic Zoology:** **Pests:** Life cycle and their control of following pests: Gundhi bug, Leaf hopper. **Vectors:** Prevention and control of Termites and Mosquitoes **Economic Zoology:** Economic importance of Lac Culture, Vermiculture and Sericulture.	14

References:

1. Barnes, R.S.K.; Calow,P.; Olive,P.J.W.; Golding,D.W.; Spicer, J.I.(2002) The Invertebrates: Synthesis,BlackwellPublishing.

2. Hickman,C.; Roberts,L.S.; Keen,S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.

3. Holland, P.(2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.

4. Kardong, K.V.(2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw-Hill.

5. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.

6. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia

7. Bushbaum, R.(1964)Animals without Back bones.University of Chicago Press

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSCC)-10

Course Title: Non-Chordates and Economic Zoology (Practical)
Course Code: 035 ZOO 012

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-10	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Understand basics of classification of non-chordates.

CO 2: Learn and understand the internal systems of non-chordates.

CO 3: Develop the skills to identify different classes and species of animals.

CO 4: Know uniqueness of a particular animal and economic importance of non-chordates.

CO 5: Enhancement of basic laboratory skill like keen observation and drawing.

CO 6: Study the useful and harmful non-chordates

Expt. No.	**DSCC-10:** **Course Title: Non-Chordates and Economic Zoology –Practical (Code: 035 ZOO 012)**	56.hrs/ sem
1	Preparation and observation of protozoan culture. **Protozoa**: Systematics of *Amoeba, Euglena, Noctiluca, Paramecium* and *Vorticella* (Permanent slides/ Charts).	4
2	**Porifera:** Systematics of *Sycon, Euplectella, Hyalonema, Spongilla* and *Euspongia* T.S of *Sycon*, Spicules and Gemmules (Specimens/ Permanent slides/ Charts)	4
3	**Cnidaria:** Systematics of *Aurelia* and *Metridium* (Specimens). Slides/Charts of *Hydra, Obelia* - polyp and medusa, and *Ephyra* larva, T.S. of *Metridium* passing through mesenteries. **Study of Corals**- *Astraea, Fungia, Meandrina, Corallium, Gorgonia, Millepora* and *Pennatula.*	4
4	**Helminthes:** Systematics of *Planaria, Fasciola hepatica* and *Taenia solium,* Ascaris- Male and female (Specimens/Charts). Slides/Charts of T.S. of *Planaria*, T.S. of male and female Ascaris.	4
5	**Annelida:** Systematics of *Nereis, Heteronereis, Sabella, Aphrodite* (Specimens/Charts). Slide/Chart of T.S. of earthworm through typhlosole.	4
6	**Arthropoda**: Systematics of *Panaeus, Palaemon, Astracus,* Scorpion, Spider, *Limulus, Peripatus, Millipede, Centipede,* Praying mantis, Termite Queen, Moth, Butterfly, Dung beetle /Rhinocerous beetle (Any six specimens). Slide/Chart of Larvae- Nauplius, Zoea, Mysis.	6

7	**Mollusca:** Systematics of *Chiton, Mytilus, Aplysia, Pila, Octopus, Sepia* (Specimens) and Glochidium larva (Slide/Chart). **Shell Pattern**- *Unio, Ostrea, Cypria, Murex, Nautilus, Patella, Dentalium,* Cuttle bone	4
8	**Echinodermata**: Systematics of Sea star, Brittle star, Sea Urchin, Sea Cucumber, Sea lilly (Specimens/Charts). Slides/Charts of Bipinnaria larva, Echinopluteusl arva and Pedicellaria.	4
9	**Harmful Non-chordates:** Soil Nematodes, Agricultural, Veterinary and Human pests (Ticks, Mites and Bugs).	4
10	**Beneficial Non-chordates:** **Sericulture:** Life cycle of *Bombyx mori*, Types of silk **Vermiculture**: Earthworm species used in Vermiculture and Vermicomposting,Vermi products	6
11	**Virtual Dissection/Cultured specimens:** Earthworm –Nervous system, Leech-Digestive system	6
12	**Virtual Dissection/Cultured specimens:** Prawn-Nervous system. Cockroach-Salivary apparatus and Digestive system.	6
13	Any other practical's related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – V

Discipline Specific Course (DSCC)-11

Course Title: Chordates and Comparative Anatomy (Theory)
Course Code: 035 ZOO 013

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-11	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: Understand the basic concept, diversity and classification of Chordates

CO2: Demonstrate comprehensive identification abilities of chordate diversity

CO3: Understand evolutionary relationship amongst all chordates

CO4: Understand the external morphology and sexual dimorphism in chordates.

CO5: Understand arrangement of endoskeleton of vertebrates.

CO6: Know the comparative anatomy of various systems, adaptations, physiological mechanisms of vertebrates.

Units	DSCC-11: Course Title: Chordates and Comparative Anatomy-Theory (Code:035 ZOO 013)	56.hrs/ sem
Unit-I	**Chordates:** Origin of Chordates; Basic characters of chordates and classification upto classes. **Protochordates:** General features and phylogeny of Protochordata, Classification of Protochordates: **Hemichordata:** Type Study: Balanoglossus- Habit and Habitat, Morphology, Coelom. Tornaria larva and its affinities. **Urochordata:** Type Study: *Herdmania*- Habit and Habitat, Morphology, Ascidian tadpole-structure and its retrogressive metamorphosis. **Cephalochordata:** Type Study: *Branchiostoma* (*Amphioxus*)-Habit and habitat, Morphology, Digestive system, Feeding mechanism, excretory and circulatory system. **Agnatha:** General characters of Agnatha and classification upto classes. Salient features of Cyclostomata and Ostracodermi with examples. Ammocoete larva and its significance.	14
Unit-II	**Vertebrates:** General characters and Classification of different classes of vertebrates (Pisces - Chondrichthyes and Osteichthyes, Amphibia, Reptilia, Aves, Mammalia) upto the orders with five characters for each order citing examples.	14
Unit-III	**Pisces:** Osmoregulation, migration and swim bladder in fishes. Types of caudal fins, scales in fishes. **Amphibia:** Origin of Amphibia, Parental care and Neoteny in Amphibia, **Reptilia:** Adaptive radiation in extinct reptiles with suitable examples. Temporal fossae in reptiles. Poisonous and non-poisonous snakes, biting mechanism in snakes, types of venom. **Aves:** Flightless birds and their distribution, Major types of beaks. Kinds of migration in birds. Flight adaptations in birds. **Mammals:** Distribution of Prototheria and Metatheria with examples. Dentition in mammals and evolution of molar tooth. Adaptive radiation in mammals.	14

Unit-IV	**Comparative Anatomy of Vertebrates:** **Integumentary System:** Structure of skin and its derivatives. **Skeletal System:** Comparative account of Axial (Skull) and Appendicular (girdles) Skeletal system in Amphibians (Frog), Reptiles (Calotes), Aves (Pigeon) and Mammals (Rabbit). Comparative account of **Digestive system** (digestive glands and alimentary canal), **Respiratory System** (gills, lungs, air sacs, swim bladder) **Circulatory System** (heart and aortic arches) and **Nervous system** (brain) in Pisces (Scoliodon), Amphibians (Frog), Reptiles (Calotes), Aves (Pigeon) and Mammals (Man). **Excretory System:** Succession of vertebrate kidney and Evolution of urino-genital ducts in vertebrates	14

References:

1. Colbert*et al*: Colbert's Evolution of the Vertebrates: A history of the back boned animals through time. (5th ed2002, Wiley–Liss).

2. Hildebrand:Analysis of Vertebrate Structure(4th ed1995,JohnWiley)

3. Kenneth V.Kardong (20015) Vertebrates:Comparative Anatomy, Function, Evolution Mc Graw Hill

4. Mc Farland *et al.,*:Vertebrate Life (1979,Macmillanpublishing)

5. Parker and Haswell: Text Book of Zoology, Vol. II(1978,ELBS)

6. Romer and Parsons:The Vertebrate Body (6th ed1986, CBS Publishing, Japan)

7.Young:The Life of Vertebrates (3rd ed 2006,ELBS/Oxford)

8. Weichert C.K. and William Presch(1970).Elements of Chordate Anatomy, Tata Mc Graw Hills

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSCC)-12

Course Title: Chordates and Comparative Anatomy (Practical)
Course Code: 035 ZOO 014

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-12	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Understand the external morphology of proto-chordates and chordates

CO 2: Study the cartilaginous, bony and ornamental fishes

CO 3: Understand the systematic position and classification of Chordates

CO 4: Study the comparative anatomy and internal systems of vertebrates

CO 5: Understand the beak and foot modifications in birds.

Expt. No.	DSCC-12: Course Title: Chordates and Comparative Anatomy –Practical (Code:035 ZOO 014)	56.hrs/ sem
1	**Protochordata**: Balanoglossus and T. S through proboscis Ascidian/*Herdmania* and *Amphioxus*, T.S. of *Amphioxus* through pharynx and intestine. **Cyclostomata:** *Petromyzon*, *Myxine*. Ammocoete larva	04
2	**Pisces**: Cartilaginous fishes – *Narcine, Trygon, Pristis, Myolobaties, Scolidion*.(Any four) Bony fishes– Zebrafish, Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon, Echeneis. (Any six).	05
3	**Ornamental fishes:** Siamese, Koi, Oscar, Betta Sp., Neon tetra, Guppies, Goldfish, Angle fish, Rainbow fish, Mollies (Any four). **Accessory respiratory organs**– *Saccobranchus, Clarias* and *Anabas.*	04
4	**Amphibia**: *Rana, Bufo, Ambystoma, Axolotl larva, Necturus and Ichthyophis.*	04
5	**Reptilia**: Turtle, Tortoise, *Mabuya, Calotes*, Chameleon, *Varanus*. **Snakes**–Dryophis, Ratsnake, Brahmini, Cobra, Krait, Russell's viper and Hydrophis.	04
6	**Aves:** Beak and feet modifications in the following examples: Duck, Crow, Sparrow, Parrot, Kingfisher, Eagle or Hawk. **Mammalia**: Mongoose, Squirrel, Pangolin, Hedge Hog, Rat and Loris, Platypus, Echidna.	05
7	**Virtual Dissection/Cultured specimens:** Shark/Bony fish: Afferent and efferent branchial systems, glosso-pharyngeal and vagus nerves.	05
8	**Virtual Dissection/Cultured specimens:** Rat: Dissection (only demonstration)– Circulatory system (Arterial and Venous), Urinogenital system.	05
9	**Comparative account of skeletal system:** Skull, vertebrae, girdles and limb bones of Shark, Frog, Calotes, Pigeon and Rabbit	05
10	**Comparative account** of skin in Shark, Frog, Calotes, Pigeon and Man.	05
11	**Comparative account** of heart in Shark, Frog, Calotes, Pigeon and Man.	05

12	**Comparative account** of brain in Shark, Frog, Calotes, Pigeon and Man.	05
13	Any other practical's related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – V

Skill Enhancement Course: SEC-3

Course Title: The Bee Keeping (Practical)
Course Code: 035 ZOO 061

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
SEC-3	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs):At the end of the course students will be able to:

CO 1: Explain what the prerequisite to get started in beekeeping

CO 2: Discuss the responsibilities of urban beekeepers.

CO 3: Identify where to purchase equipment and demonstrate how to assemble it.

CO 4: Name and identify major parts of the honeybee such as mouth parts, sting apparatus and mandibular parts.

CO5: Describe bee biology and anatomy from the perspective of managing bees.

CO 6: Describe the importance and usage of honey and bee wax.

Expt. No.	SEC-3: Course Title: The Bee Keeping-Practical (Code:035 ZOO 061)	56.hrs/ sem
1	Study of general characters and anatomy of honey bee	6
2	Systematic position and classification of honey bee	2
3	Study of life cycle of honey bee	4
4	Mounting of mouth parts/sting apparatus of honey bee	4
5	Study of castes in honey bees	4
6	Identification of honey bee species	4
7	Study of social organization in honey bees	4
8	Requirements of bee keeping: Hive, Protective gear, smoker, hive tool and other equipments (Charts)	4
9	Study of honey bee by-products and their uses (Charts)	4
10	Study of diseases of honeybees (Charts)	4
11	Study of pests of honeybees (Charts)	4
12	Field study/Project report on nearby Apiary/bee keeping unit and submit a report	12
13	Any other practical's related to this paper may be added based on the feasibility	

References:

1. Abrol , D. P. (1997) Bees and Beekeeping. Kalyani Publisher, New Delhi. 173
2.Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
4.Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai.
5. Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.
6. Prost, P. J. Apiculture. Oxford and IBH, New Delhi.
7. Bisht D.S. Apiculture, ICAR Publication.
8. Bisht, D.S. Agricultural Development in India, Anmol Pub. Pvt. Ltd.
9. Singh S. Beekeeping in India, Indian council of Agricultural Research, New Delhi
10. Mehrotra, K.N. Bisht, D.S. Twenty-five years of apiculture research at IARI.

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**06**
2. Minor Experiments	**04**
3.Identifications (A-C)	06
4. Viva	**02**
5. Journal	**02**
6. Field visit report	**05**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. in Zoology

VI Semester

W. E. F: 2023-24

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-13

Course Title: Evolutionary and Developmental Biology (Theory)
Course Code: 036 ZOO 011

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-13	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs):At the end of the course students will be able to:

CO 1: Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.

CO 2: Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change.

CO 3: Understand how the single cell formed at fertilization forms an embryo and then a full adult organism.

CO 4: Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.

CO 5: Understand a variety of interacting processes, which generate an organism's heterogeneous shapes, size, and structural features.

Units	**DSCC-13:** **Course Title: Evolutionary and Developmental Biology-Theory (Code:036ZOO 011)**	**56.hrs/ sem**
Unit- I	Origin of Life and theories**;** Historical review of evolutionary concept. **Theories of Evolution:** Lamarckism, Darwinism (Natural, Sexual and Artificial selection), Mutation Theory of Evolution (Hugo de Vries) and Neo- Darwinism (Synthetic theory of evolution, gene mutation, gene flow, genetic drift, Hardy-Weinberg equilibrium). Adaptive radiations: Patterns of evolution (Divergence, Convergence, Parallel, Co-evolution).	14
Unit- II	**Evidences of Evolution**: Relationship among organisms, Morphological and Anatomical evidences, Embryological evidences, Paleontological evidences, Bio-geographical evidences, Biochemical/Physiological evidences, Cytological evidences, Taxonomical evidences and Current evidences. **Geological Time Scale**/ Stratigraphic Scale. **Species Concept and Extinction**: Concept of species; Modes of speciation: Allopatric and Sympatric species; Mass extinction (Causes, Names of five major extinctions) **Origin and evolution** of Human and Horse.	14

Unit- III	**Introduction to Developmental Biology:** Scope and theories of development biology **Early Embryonic Development:** **Gametogenesis:** Spermatogenesis and oogenesis in mammals. **Fertilization:** external (amphibians), internal (mammals), monospermy and polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.	14
Unit- IV	**Embryonic membranes and early development of Chick:** Development, structure and functions of yolk sac, amnion, chorion and allantois, structure of hen's egg, cleavage, blastula, gastrulation, origin and structure of primitive streak, structure of 18, 24, 36 and 48 hrs chick embryos. **Placenta:** Classification of placenta (morphological and histological) with examples, and functions of placenta. **Modern trends in human reproduction**: In-vitro fertilization, sperm and egg banks, sexually transmitted diseases (AIDS, syphilis and gonorrhea).	14

References:

1. Ridley, M (2004) Evolution (3rd edition) Blackwell Publishing

2. Hall, B.K. and Hallgrimson, B(2008)Evolution(4th edition) Jones and Barlett Publishers

3. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.

4. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.

5. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.

6. Developmental Biology: T. Subramaniam, (Reprint), Narosa Publishing House Pvt. Ltd., New Delhi

7. Developmental biology: Werner A. Müller, Springer Science & Business Media. (2012).

8. Human Embryology and Developmental Biology E-Book: Bruce M. Carlson, Elsevier Health Sciences.

9. Developmental Biology: Michael J. F. Barresi, Scott F. Gilbert, Oxford University Press. (2019)

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-14

Course Title: Evolutionary and Developmental Biology (Practical)
Course Code: 036 ZOO 012

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-14	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Explain core features of evolutionary theory and their applications to biological systems.

CO 2: Explain how evolutionary patterns and processes can be inferred using sequence data, the biology of extant organisms, and fossils.

CO 3: Study the process by which organisms grow and develop.

CO 4: Understand the development of multicellular organisms from a single cell zygote.

CO 5: Learn interesting and unique post-embryonic development in other animals.

CO 6: Understand the concept of aging and the relevance of this knowledge in several medical applications.

Expt. No.	DSCC-14: Course Title: Evolutionary and Developmental Biology-Practical (Code:036 ZOO 012)	56.hrs/ sem
1	Study and verification of Hardy-Weinberg Law by chi-square analysis.	3
2	Graphical representation and interpretation of data of height/weight of a sample of 100 humans in relation to their age and sex	3
3	Study of connecting links and fossils (models/pictures); Connecting links/ Living fossils: Neopilina, Peripatus, Limulus, Latimeria, Sphenedon, Archeopteryx and Duck Billed Platypus	3
4	Study of homology and analogy from suitable examples.	3
5	Study of aquatic, arboreal and volant adaptations with suitable examples: Shark, Turtle, Chameleon, Loris, Exocoetus, Bat, Pigeon and Draco	4
6	Vestigial organs: Vermiform appendix, Wisdom teeth, Coccyx (tail bone), Tonsils, Body hairs, Nipples on males, Nictitating membranes of eye (Any three)	4
7	Types of eggs based on quantity and distribution of yolk: Sea urchin, Insect, Frog, Chick.	5
8	Study of development of chick embryo through incubated chick eggs upto 96hrs	6
9	Study of stages of development of Frog: Cleavage stages, Blastula, Gastrula, Neurula stages (whole mount) and various stages of tadpole	6
10	Study of permanent slides of Chick embryo -18 hrs, 24 hrs, 36 hrs, 48 hrs (whole mount and T.S of 18 hrs and 24 hrs chick embryo)	6
11	Evolution of Man and Horse (Charts and models)	6
12	Study of Mesozoic Reptiles (Charts or models);	7

	Study of adaptive radiations in feet of birds and mouth parts in insects with example	
13	Any other practical related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-15

Course Title: Environmental Biology, Wildlife Management and Conservation (Theory)
Course Code: 036 ZOO 013

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-15	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Develop an understanding of how animals interact with each other and their natural environment.

CO 2: Get knowledge about all types of ecosystems, food chains, webs and energy models.

CO 3: Study various types of environmental pollutions

CO 4: Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.

CO 5: Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.

CO 6: Develop an ability to analyze, present and interpret wildlife conservation management information.

Units	**DSCC-15:** **Course Title: Environmental Biology, Wildlife Management and Conservation-Theory (Code:036 ZOO 013)**	**56.hrs/ sem**
Unit I	**Ecology:** Introduction to ecology, Definition, Ecosystem, Types of ecosystem, Food chain and Food web, Trophic levels. **Environment:** Definition, Types of environment, Terrestrial, Aquatic, Desert, Grassland and Aerial environment. **Marine habitat: Z**onation of the sea and ecological classification of marine biota, coastalecology, estuarine ecology and mangroves. **Freshwater habitat**: Lentic and Lotic systems. Ecological classification of fresh water animals **Terrestrial habitat**: A brief account of biomes Ecological adaptations to marine, freshwater and terrestrial habitats.	14
Unit II	**Environmental Pollution:** Definition, types of pollutants, air, soil, water and thermal pollution, ozone layer depletion, biomagnifications, bioaccumulation and bioremediation. Effects of pollution on plants and animals. **Toxicants –** Natural and synthetic toxicants and toxicity measurements. Global warming, Acid rain, Bio-accumulation, Bio-magnification, Eutrophication-Types and its impact.	14

Unit III	**Distribution of Wildlife in India:** The Himalayan ranges, The peninsular India sub-region, Deccan plateau, Western ghats, Eastern hill chain, Aravali ranges, Indian desert, Tropical rain forests, Wildlife in Andaman and Nicobar Islands. **Wild life problems:** Hunting, overharvesting, habitat destruction &degradation, over population, and possibilities of climatic changes.	14
Unit IV	**Wildlife Management and Conservation:** In-situ and ex-situ conservation methods; Wildlife sanctuaries, National parks, Biosphere reserves, Project Tiger, Project Elephant, Project Lion, Zoological Gardens, Habitat preservation and Captive breeding. Wildlife Protection Act, 1972, Causes and depletion of Wildlife, General strategies and issues, Concept of home range and territory, Animal census, Tracing movement and Remote sensing and GIS.	` 14

References:

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2. Krebs,C.J.(2001) Ecology (6th edition) Benjamin Cummings.
3. Odum,E.P.,(2008)Fundamentals of Ecology. Indian Edition. Brooks/Cole. (3rd Edition) Blackwell Sci.
4. Kendeigh, FC.(1984) Ecology with Special Reference to Animal and Man. Prentice HallInc.
5. Caughley,G.,and Sinclair,A.R.E.(1994)Wildlife Ecology and Management. Blackwell Science.
6. Woodroffe,R.,Thirgood,S.and Rabinowitz,A.(2005) People and Wildlife, Conflict or Co-existence? Cambridge University.
7. Bookhout,T.A.(1996) Research and Management Techniques for Wildlife and habitats(5th edition) The Wildlife Society,Allen Press.
8. Sutherland,W.J.(2000)The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
9. Hunter M.L.,Gibbs, J.B.and Sterling, E.J.(2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-16

Course Title: Environmental Biology, Wildlife Management and Conservation (Practical)
Course Code: 036 ZOO 014

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-16	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Understand the basic concepts of environmental sciences, ecosystems, natural resources, population, environment and society

CO 2: Understand the basic concepts of toxicology, their impact on human health and remedial measures

CO 3: Provide understanding and knowledge on modern concepts in wildlife management and relevant conservation policies and legislation and their enforcement mechanism at Global and Local Level,

CO 4: Understand the scientific approach to wildlife management and planning.

CO 5: Develop scientific skills for resolving human wildlife conflict including capture, handling, care and management of wild animals.

Expt. No.	**DSCC-16:** **Course Title: Environmental Biology, Wildlife Management and Conservation-Practical (Code: 036 ZOO 014)**	56.hrs/ sem
1	Collection of water sample and analysis of physical parameters of water: Temperature, pH, Electrical Conductivity.	4
2	Estimation of chemical parameters of water: Dissolved Oxygen (O_2), Carbon Dioxide (CO_2), Hardness, Chloride, Alkalinity, Total dissolved solids (TDS).	6
3	Analysis of physical parameters of soil: pH, EC, Soil moisture, Soil temperature	2
4	Determination of organic matter in the soil sample	4
5	Study of tropical pond as an ecosystem: Study of flora and fauna and interaction between the various constituents using charts.	4
6	Analysis of air pollution: Air monitoring for particulate matter	4
7	Collection, preservation and estimation of zooplanktons	4
8	Study of threatened animals of India (charts/models/pictures): Tiger, Lion, one horned Rhinoceros, Golden langur, Lion tailed monkey, Musk deer, Kashmir stag, Great Indian horn bill and Indian rock python.	4
9	Location of Tiger reserves, National parks, Biosphere reserves, Wildlife sanctuaries of India on Map.	4

10	Demonstration of field equipments used in Wildlife census**:** Compass, Binoculars, Spotting scope, Range finders, Global Positioning System, Various types of cameras and lenses.	4
11	Identification wild animals**:** Wild animal's pugmarks, hoof marks scats, pellet groups, nest, antlers. Demonstration of field techniques for wild flora and fauna.	4
12	Visit to Zoo/ Sanctuaries/ National parks/ Biosphere reserves	12
13	Any other practical's related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – VI
INTERNSHIP

Course Title: Internship (Practical)
Course Code: 036 ZOO 091

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
Internship	**Practical**	**02**	**04**	**56 hrs.**	**-**	**50**	**0**	**50**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Explore career alternatives prior to graduation and Integrate theory and practice

CO 2: Assess interests and abilities in their field of study/ research.

CO 3: Develop work habits and attitudes necessary for job success

CO 4: Build a record of work experience

CO 5: Identify, write down, and carry out performance objectives related to the job assignment

Expt. No.	**Internship:** **Course Title: Internship-Practical (Code: 036 ZOO 091)**	**56.hrs/ sem**
1	Small Laboratory Research Projects related to Zoology **OR**	56
2	Field Study Report: Survey of animal biodiversity nearby villages/ ecosystem **OR**	
3	Survey of insect vectors/ animal diseases/human diseases/blood groups etc. **OR**	
4	Any other work related to this paper may be added based on the feasibility	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Project / Survey work / Field Study Report submission	25
Internal marks based on the performance of work by mentor	10
Presentation of work	15
Total	**50 Marks**
Formative Assessment as per guidelines.	

Internship:

A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations for 2 credits. Internships involve working with local industry, local governments (such as panchayats, municipalities) or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Note:

1. 1 credit internship is equal to 30hrs on field experience.
2. Internship shall be Discipline Specific of 45-60 hours (2 credits) with duration 1-2 weeks.
3. Internship may be full-time/part-time (full-time during last 1-2 weeks before closure of the semester or weekly 4 hrs in the academic session for 13-14 weeks).
4. College shall decide the suitable method for programme wise but not subject wise.
5. Internship mentor/supervisor shall avail work allotment during 6^{th} semester for a maximum of 20 hours.
6. The student should submit the final internship report (45-60 hours of Internship) to the mentor for completion of the internship.
7. Method of evaluation: Presentations/Report submission/Activity etc.

UG programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 Marks for Semester End Examination with 2 Hrs duration)

Part-A

1. Question number 01- 06 carries 2 Marks each. Answer any 05 questions : 10 Marks

Part-B

2. Question number 07 - 11 carries 05 Marks each. Answer any 04 questions : 20 Marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 Marks
(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

(Note: Proportionate weightage shall be given to each unit based on number of hours prescribed)