KOLHAN UNIVERSITY, CHAIBASA

B. Sc. Zoology Honours

MARKS DISTRIBUTION

Semester	Course	Name of Paper	No. of credits	Total Credits	Full Marks	TOTAL		
I	CCZOO 1 Theory	Systematics &Animal diversity	4	20	70	350		
	CCZOO2 Theory	Animal Form and Function of Invertebrates	4		70			
	CCZOO Practical		4		60			
	AECC1 Compulsory	MIL Communication	2		50			
	Generic Elective1	GE-1 (Theory)	4		70			
	Generic Elective (P)	GE-1 (practical)	2		30			
II	CCZOO3 Theory	Cell Biology	4	20	70	350		
	CCZOO4 Theory	Diversity of Chordata	4		70			
	CCZOO Practical		4		60			
	AECC2 Compulsory	Environmental Science	2		50			
	Generic Elective2	GE-2 (Theory)	4		70			
	Generic Elective (P)	GE-2 (practical)	2		30			
III	CCZOO5 Theory	Physiology	4		70			
	CCZOO6Theory	Endocrinology and Animal Physiology	4		70			

	CCZOO7 Theory	Developmental Biology	4		70			
	CCZOO Practical		6		90	450		
	SEC 1	Current Affairs	2		50			
	Generic Elective-3	GE-3 (Theory)	4	**26**	100			
	Generic Elective (P)	GE-3 (practical)	2					
IV	CCZOO8 Theory	Genetics	4		70			
	C9Theory	Evolution	4		70			
	C10 Theory	Animal behaviour	4		70	450		
	CCZOO Practical		6	**26**	90			
	SEC2	Personality Development	2		50			
	Generic Elective-4	GE-4 (Theory)	4		70			
	Generic Elective	GE-4 (practical)	2		30			
V	CCZOO11Theory	Immunology	4		70			
	CCZOO12 Theory	Environmental biology & toxicology	4		70			
	CCZOO Practical		4		60	400		
	DSE1Theory	Economic	4		70			

		Zoology						
	DSE2 Theory	Biostatistics	4	**24**	70			
	DSE Practical		4		60			
VI	CCZOO13Theory	Molecular biology & Biotechnology	4		70			
	CCZOO14 Theory	Microbiology & Medical Zoology	4		70	400		
	CCZOO Practical		4		60			
	DSE3Theory	Toxicology	4	**24**	70			
	DSE3Practical		2		30			
	DSE4	Project	6		100			
		TOTAL		**140**		2400		

- **CIA :-** *Continuous Internal Assessment .*
- **AECC :-** *Ability Enhancement Compulsory Course.*
- **SEC :-** *Skill Enhancement Course .*

PROPOSED SYLLABI FOR CHOICE BASED CREDIT SYSTEM
B.Sc. Hons. In Zoology (Six Semester Course)

SEMESTER-I

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
(A) CORE Course	CZOOL-1	Systematics &Animal diversity	04	12
	CZOOL-2	Animal Form and Function of Invertebrates	04	
	P-1	Practical based in CZOOL -1 & 2	04	
(B) AECC Ability Enhancement Compulsory Course	AECC-1	Communicative English Basic of computers /	02	02
(C) Generic Elective	GE-1	GE-1 (Theory)	04	06
		GE-1(Practical)	02	
			Total credits	20

Semester - II

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	CZOOL-3	Cell Biology	04	12
	CZOOL-4	Diversity of Chordata	04	
	P-2	Practical based on CZOOL-3 & 4	04	
(B) AECC Ability Enhancement Compulsory Course	AECC-2	Environmental Science	02	02
(C) Generic Elective	GE-2	GE-2 (Theory)	04	06
		GE-2(Practical)	02	
			Total	20

Semester –III

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	CZOOL-5	Physiology	04	18
	CZOOL-6	Endocrinology and Animal Physiology	04	
	CZOOL-7	Developmental Biology	04	
	P-3	Practical based on CZOOL-5,6&7	06	
(B) Skill Enhancement Course	SEC-1	Current Affairs	02	02
Generic Elective	GE-3	GE-3 (Theory)	04(T)	06
		GE-3 (Practical)	02	
			Total	26

Semester -IV

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	CZOOL-8	Genetics	04	18
	CZOOL-9	Evolution	04	
	CZOOL-10	Animal behaviour	04	
	P-4	Practical based on CZOOL-8,9 & 10	06	
(B) Skill Enhancement Course	SEC-2	Personality Development	02	02
Generic Elective	GE-4	GE-4 (Theory)	04	06
		GE-4 (Practical)	02	
			Total	26

SEMESTER - V

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	CZOOL-11	Immunology	04	12
	CZOOL-12	Environmental biology & toxicology	04	
	P-5	Practical based on CZOOL-11& 12	04	
Discipline specific Elective	DSE-1	Economic Zoology	04	12
	DSE-2	Biostatistics	04	
	P-6	Practical based on DSE-1 & DSE-2	04	
			Total	24

SEMESTER- VI

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	CZOOL-13	Molecular biology & Biotechnology	04	12
	CZOOL-14	Microbiology & Medical Zoology	04	
	P-74	Practical based on CZOOL-11& 12	04	
Discipline specific Elective	DSE-3	Toxicology	04	12
	DSE-4	Project Work	04	
	P-8	Practical based on DSE-3	04	
			Total	24

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc Honours in Zoology

(Six Semester Course)

1ST SEMETER

B.Sc. (Hons.) Zoology

Semester- I , Core Course (CZOOL-1)

Systematic and Animal Diversity

Full Marks 70
(Credit 4)

UNIT-1 :- Systematics

1.1-Binomial & Trinomial nomenclature,
1.2- Concept of Species.
1.3 - New trends in animal Taxonomy.
1.4. Biological Classification

UNIT-2- Non–Chordates:

- General characters and classification of the following up to orders with examples showing distinctive / adaptive features

2.1. Protozoans
2.2. Poriferans
2.3. Cnidarians
2.4. Ctenophorans
2.5. Platyhelminths
2.6. Annelids.
2.7.Arthropoda
2.8. Molluscs
2.9.Echinoderms

UNIT-3 :-

3.1.Evolution of Metazoan.
3.2. Life cycle of Fasciola hepatica . & Ascaris .

UNIT :- 4:- General Characters and affinities of:
4.1. Ctenophora
4.2. Onychophora

Semester -1 , Core Course (CZOOL-2)

Animal Form and Function of Invertebrates

Full Marks 70
(Credit 4)

UNIT-1 Phylum Protozoa

1.1 locomotion and reproduction in protozoa.
1.2 Nutrition in protozoa.

UNIT-2 Phylum Porifera

2.1 Canal system in Porifera
2.2 . Spicules of Porifera , Gemmules .

UNIT-3 Phylum Coelenterate & Platyhelminthes

3.1 Obelia –Life cycle and metagenesis
3.2 Polymorphisms in hydrozoa
3.3 Coral and Coral Reefs –types, formation, distribution and economic importance.

UNIT-4 Phylum Annelida & Arthropoda
[Classification & Excretory System]

4.1. Segmental organs (Nephridia and Coelomoduct) in annelids
4.2 . Respiration in Pila and Unio
4.3. Torsion and Detorsion in Gastropods
4.4 . Respiration in Arthropods
4.5 . Larval forms of Crustacea

UNIT-5 Phylum Echinodermata .

5.1 Water vascular System in Echinoderms
5.2 Larval forms of echinoderms

P-1 Practical Based on (CZOOL-1 & CZOOL-2)

Full Marks 60 **Credit - 4**

ITEM	MARKS DISTRIBUTION
1. Dissection.	10
2. Spotting (10)	30
3. Whole mount ✓ Nephridia of eartworm. ✓ Statocyst of palaemon.	05
4. Practical Record	10
5. Viva Voce	05

P-1 Practical Based on (CZOOL-1 & CZOOL-2)

Full Marks 60
(Credit 4)

1. Dissection :-

- ✓ Nervous system of earthworm .
- ✓ Nervoes system of palaemon .
- ✓ Internal anatomy of pila.

2. Whole mount :-

- ✓ Nephridia of earthworm.
- ✓ Statocyst of Palaemon.

3. Systematics and Animal Diversity

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1. Zoological names of some common animals.
2. Fixation of fresh water protozoans
3. Study of Available Museum Specimensof animals
   - ✓ Sycon (As an example of parazoa),
   - ✓ Hydra(as an example of diploblastic animal),
   - ✓ Fasciola(as an example of triploblastic acoelomate animal),
   - ✓ Ascaris(as an example of triploblastic pseudocoelomate animal),
   - ✓ Hirudinaria (as an example of triploblastic schizocoelomate animal),
4. Study of the following through permanent slides
   - ✓ Paramecium Slide (WM)
   - ✓ Gemmules of sponges
   - ✓ Conjugation in Paramoecium, ,
   - ✓ Nauplius and Zoea larvae, Bipinnaria,

Animal Form and Function

1. Dissection of Digestive and nervous system of Earthworm
2. Mounting of nephridia, ovary of earth worm
   - ✓ Study and mounting of cephalic appendages of Palaemon
3. Dissection of nervous system of Palaemon
   - ✓ Mounting of statocyst of Palaemon
4. Demonstration of internal anatomy of Pila

Books Recommended

1. Dalela & Sharma: Animal Taxonomy and Museology (1976, Jai PrakashNath).
2. Kapoor: Theory and Practicals of Animal Taxonomy (1988, Oxford & IBH).
3. Simpson: Principles of Animal Taxonomy (1962, Oxford).
4. Roymahoney: Laboratory Techniques in Zoology (1966, Butterworths).
5. Mayer &Ashlock: Principles of Systematic Zoology (1991, McGraw Hill).
6. Boolotian& Stiles: College Zoology (10thed 1981, Macmillan)
7. Campbell & Reece: Biology (7thed 2005, Pearson)
8. Dorit, Walker & Barnes: Zoology (1991, Saunders)
9. Taylor,.Green& Stout : Biological Sciences (3rded. 2005, Cambridge)
10. Mader: Biology (9thed. 2007, W.C. Brown)
11. Marshall & Williams: Textbook of Zoology, Vo
12. Parker &Haswell, 7th ed. 1972, Macmillan)
13. Nigam: Biology of Non-chordates (1997, S Chand)
14. Parker &Haswell: Text Book of Zoology, Vol. II (2005, Macmillan)
15. Purves et al: Life-the Science of Biology, (7thed. 2004, Sinauer)
16. Starr: Biology, Concepts and Applications (1991, Wadsworth)
17. . Tortora and Anagnostakos: Principles of Anatomy and Physiology (6thed. 1986, Harper & Row).
18. Villee, Walker &Baranes: General Zoology (5thed 1979, Saunders)
19. . Wolfe: Biology – the Foundations (1987, Wadsworth)
20. . Schmidt Nielson: Animal Physiology (5thed. 2005, Cambridge)
21. . Arms and Camp: Biology (4thed. 1995

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc Honours in Zoology

IInd SEMETER

B.Sc. (Hons.) Zoology

Semester II , Core Course (CZOOL-3)
Diversity of Chordate

Full Marks 70
Credit-4

UNIT-1-.Chordata: General characters and classification of the following up to sub-classes with examples

1.1. Protochordates: Urochordates, Cephalochordates
1.2. Cyclostomes :- Silent features & affinity .
1.3. Fishes :- Digestive and Respiratory system .
1.4. Amphibians :- parental Care , Origin & evolution ,Classification of living amphibians .
1.5. Reptiles :- Classification [living] ,Biting & Feeding mechanism of Snakes.
1.6. Birds :- Origin , Flight adaption and migration
1.7. Mammals :- Prototheria , Metatheria , affinity & General account .

UNIT-2 Cyclostome, Fish & Amphibians

2.1. Pedogenesis and neoteny with special reference to Axolotl larvae
2.2.Gill structure and Respiration in Chodrichthyes and Osteichthyes

UNIT-3. Reptiles

3.1.Poisonous ,Nonpoisonous Snakes of India, Poison-Apparatus , Venom in Ophidians .

UNIT -4. Comparative Anatomy

4.1- Comparative anatomy of heart, integument , , aortic Arches And kidney in vertebrates

Semester II , Core Course (CZOOL-4)
Cell Biology

Full Marks 70
Credit-4

UNIT-1 The Cell and its Organization

1.1. Introduction to cell theory

1.2 . Structure and function of plasma membrane

1.3. Endo-membrane system (endoplasmic reticulum, golgi complex, lysosome), Protein Sorting, , Polymorphism in Lysosome

1.4 Structure and function of Mitochondria, Role in Oxidative Phosphorylation

UNIT-2.Nucleus

2.1 :- Introduction to polytene and lampbrush chromosomes, Aberration[structural change]

2.2.:- Organisation of Chromatin, Nucleosome, Euchromatin and Heterochromatin

2.3:- Nucleolus

UNIT-3. Cell reproduction

3.1 Basis feature of cell cycle

3.2 Mitosis & Meiosis

UNIT-4 Elementary idea of cancer

UNIT-5 Cytoskeleton

5.1.Structure and function : Microtubules, Microfilament , and Intermediate filaments.

P-2 Practical based on CZOOL-3 & CZOOL-4

Full Marks 60 Credit 4

ITEM	MARKS DISTRIBUTION
1. Dissection.	**10**
2. Spotting (10)	**30**
3. Mounting of Scale of Fishes.	**05**
4. Slides Preparation	**05**
5. Practical Record	**05**
6. Viva Voce	**05**

P-2 Practical based on CZOOL-3 & CZOOL-4

Full Marks 60

Credit-4

1. Dissection to show afferent and efferent branchial arteries of Scoliodon or Bony Fish .

2. Mounting:-

- Mounting of Scale of Fishes, [scoliodon , bonny Fishes]

3.Slides Preparation :-

- Preparation of mitotic slides from onion root tips.
- Study of Blood cells through slide preparation.

Study of slides of Unicellular Eukaryotic cell –Amoeba, Paramoecium

Study of various stages of cell division through permanent slides-Mitosis and Meiosis

- Protochordata : - Balanoglossus, Herdmania, Branchiostoma,
- Agnatha :- Petromyzon, Myxine
- Fishes ;- Scoliodon, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, ,Anabas
- Amphibia :- Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
- Reptilia : - Chelone, Hemidactylus, Varanus, Uromastix, Chamaeleon, , Draco, Bungarus, Vipera, Naja, Hydrophis Key for Identification of poisonous and non-poisonous snakes
- Aves : - Study of six common birds from different orders. Types of beaks and claws
- Mammalia :- Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous.

Books Recommended

Cell Biology

1. Alberts et al: Essential Cell Biology (1998, Garland)

2. Alberts et al: Molecular Biology of the Cell (2008, Garland)

4. Karp: Cell and Molecular Biology (2008, John Wiley)

5. Lodish et al: Molecular Cell Biology (2008, Freeman)204

6. Pollard & Earnshaw: Cell Biology (2002, Saunders)

7. Cooper and Hausman: The Cell A Molecular approach (2007, Sinauer)

Vertebrate Zoology

1. Nigam: Biology of Chordates (1997, S Chand)

2. Hoar: General and Comparative physiology (7thed. 2005), Indian reprint.

3. Miller & Harley: Zoology (6thed. 2005, W.C. Brown

4. Vertebrate R.l. Kotpal

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc Honours in Zoology

IIIrd SEMETER

CZOOL - 5 Mammalian Physiology Credit -4(Th)
CZOOL - 6 Endocrinology and Animal Physiology Credit -4(Th)
CZOOL - 7 Developmental Biology Credit -4(Th)
CZOOP- 3 Credit - 6

Semester:- III

CZOOL-5:- Mammalian Physiology
Full Marks 70 Credit 4

UNIT-1. Respiration

1.1 Mechanism and regulation of breathing
1.2 Transport of oxygen and carbon dioxide

UNIT-2. Circulation

2.1 Composition and function of blood .
2.2 Structure and function of Hb.
2.3 Blood groups

UNIT3. Nutrition and Digestion

3.1. Digestion of carbohydrates, proteins and fats

UNIT-4. Excretion

4.1.Strucure of Kidney, ,
. 4.2. Urine formation

UNIT-5. Nervous System

5.1 Structure and types of Neuron
5.2.Conduction of Nerve impulse through Axon and Synapse
5.3 Reflex action

UNIT-6.Reproduction

6.1. Histological details of testes and functions
6.2. Histological details of ovary and functions
6.3. Reproductive Cycle

CZOOL:- 6 Endocrinology and Animal Physiology

Full Marks 70
Credit 4

UNIT-1.Hormonal Messenger :-

1.1 Hormones and its classification
1.2 Neurotransmitters

UNIT -2 Structure and function of endocrine glands

2.1 Pituitary
2.2 Thyroid
2.3.Adrenal
2.4. Pancreas, Pineal, Parathyroid

UNIT-4 Endocrine Disorders:

4.1**.** Goitre,
4.2. Cushing's Disease,
4.3. Addisson's Disease

UNIT-5 Tissues:-

5.1**.**Structure, location, classification and functions of Epithelial,connective & muscular

UNIT-6 Bone and Cartilage.

CZOOL :-7 :-Developmental Biology

Full Marks 70

Credit 4

UNIT-1 Gametogenesis and Fertilization

1.1 Spermatogenesis and Oogenesis
1.2 Pre fertilization Events: Attraction of gametes, Acrosomal Reaction,
1.3 Post fertilization events- Prevention of Polyspermy, Cortical reaction

UNIT-2 Early embryonic development

2.1 Types of vertebrate egg
2.2 Patterns of cleavage
2.3 Gastrulation, morphogenetic movements

UNIT-3 Late embryonic Development

3.1. Extra embryonic membranes in chick
3.2. Placenta (Structure Type and function)

UNIT-4Post Embryonic Development

4.1. Metamorphosis in frog
4.2. Regeneration
4.3. Concepts of Ageing

Practical based on CZOOL-5, CZOOL-6 & CZOOL-7
CZOOP - 3

Full Marks 90
Credit :2+2+2=6

Mammalian Physiology

1. Preparation of Haemin Crystal
2. RBC count by using haemocytometer
3. Estimation of Haemoglobin using Sahil's method
4. Record of blood pressure by Sphygmomanometer
5. Study of permanent slide of transverse section of organs:
6.Lung, Stomach, liver, kidney, intestine

Endocrinology and Animal Physiology

1. Study of permanent slide of Endocrine gland: Thyroid, Islets of Langerhans ,Adrenal, Pituitary, Testis , Ovary

Developmental Biology

1. Study of permanent Slide of Frog Embryo (W.M)
2. Study of permanent slide of chick embryo (W.M)
3. Study of Life cycle through Models/specimens of Silk worm, Lac Insect/Honey bee

Suggested Reading

Physiology

1. Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2008, Cambridge)
2. Marshall and Hughes: Physiology of Mammals and Vertebrates (2nd ed. 1980, Cambridge)
3. Hoar: General and Comparative Physiology (3rd ed., 1987, Prentice Hall)
4. Prosser: Comparative Animal Physiology (4th ed. 1991, Satish Book)
5. C.C.Chaterjee Medical physiology
6. Guyton– a book on medical physiology

Endocrinology

1. Hadley: Endocrinology (5th ed. 2000, Prentice Hall)
2. Turner and Bagnara: General Endocrinology, 6th ed.1984, Saunders)

Developmental Biology

1. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
2. Balinsky: An Introduction to Embryology (1981, CBS)
3. Gilbert: Developmental Biology (8th ed., 2006, Sinauer)
4. Wolpert: Principles of Development (3rd ed. 2007, Oxford)

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc Honours in Zoology

IVth SEMETER

CZOOL -8 Genetics	**Credit -4**
CZOOL -9 Evolution and Animal Behaviour	**Credit -4**
CZOOL -10 Biochemistry	**Credit -4**
CZOOP- 4	**Credit -6**

Semester IV

CZOOL -8 :- Genetics

Full Marks 70
Credit-4

UNIT-1. Elements of heredity and variation

1.1.DNA and RNA as genetic material
1.2. Mendel and his experiments
1.3. Principles of segregation and independent assortment with cytological explanation.

UNIT-2. Extension of Mendelism

2.1 Dominance relationships (Complete dominance incomplete dominance and co-dominance)

2.2. Pleiotropy
2.3 .Epistasis

UNIT-3. Cytoplasmic inheritance

UNIT-4. Linkage

4.1 Linkage and crossing over
4.2 Cytological demonstration of crossing over in Drosophila
4.3 sex- linkage

UNIT-5 Sex Determination

5.1 sex chromosomes systems and Sex determination : XX/XO, XX/XY, ZZ/ZW and haploidy/ diploidy types

5.2.Sex limited and sex influenced traits

UNIT-6. Mutation-

6.1. Point Mutation .
6.2 .Single gene disorder
6.3.Genetic Anomaly /Disorders/syndrome :- Down, Turner, Klinefelter syndromes chronic myeloid leukemia and "cri -du -chat" syndrome)

CZOOL :- 9 : Evolution and Animal Behaviour

Full Marks 70
Credit 4

UNIT-1 History of diversified life

1.1. Geological Time Scale And Geological Era
1.2. Zoogeographical regions (Oriental, Australian and Ethiopian Regions/Realms

UNIT -2 Introduction to evolutionary Theories

2.1 Lamarkism
2.2 Darwinism
2.3 Neo Darwinism

UNIT-4. Source of heredity variation and evolution

4.1.Isolation
4.2.Natural Selection, types
4.3.Speciation
4.4. Evolution of Man and Horse

UNIT-5 .Hardy Weinberg law of Equilibrium

5.1. Genetic Drift
5.2. Founder effect

UNIT-6. Concepts and pattern of Behaviors

6.1 Innate Behaviors

6.2 learned behavior

UNIT-7. Social organization in insects :-

7.1. Honey Bee,

7.2. Migration in Birds

7.3. Parental Care in fishes and Amphibian

CZOOL -10 :- Biochemistry

Full Marks 70
Credit 4

UNIT-1. Proteins

1.1. Structural & functions of proteins.
1.2. Lipids- Types, structure & biological significance

UNIT-2. Enzymes

2.1. General properties & Classification
2.2. Vitamins.

UNIT-3. Carbohydrates

3.1. Classification.
3.2. Structure and conformation of monosaccharide's

UNIT-4. Nucleic acids

4.1. DNA structure: DNA double helix (Watson and Crick model)
4.2. Types of RNA

UNIT-5. Metabolic path way

5.1 Glycolysis
5.2 Krebs's cycle

Practical based on CZOOL-8, CZOOL-9 & CZOOL-10
CZOOP – 4

Full Marks 90 **Credit 6**

CZOOL-8 Genetics **Credit -2**
CZOOL-9 Evolution **Credit -2**
CZOOL-10 Animal Behaviour **credit - 2**

Genetics

1. Simulation of principles of segregation and independent assortment using coloured beads. Application of law of probability and chi-square test.

2. Study of pattern of inheritance in human population of the traits Rolling of tongue and interlocking, and of the sex-influenced trait long vs short second finger in relation to the Fourth finger (apply Hardy-Weinberg law).

3. Study of mutants in *Drosophila* (Bar eye, white eye, yellow body, sepia eye, curled wing, Dumpy wing, vestigial wing and sepia eye-curled wing and curled wing-ebony body-sepia Eye.

4. Genotype analysis in the pedigree chart of the Victorian family affected with haemophilia

Evolution

.1. Genotypic analysis of blood groups in human population to estimate allele frequencies by Hardy -Weinberg equation

2. Fossils – One representative fossil each from Foraminifera, Brachiopoda, Trilobita, Ammonites, Echinodermata. Living fossils (Limulus, Peripatus, Sphenodon)

3. Evolution of Horse – through models

4. Study of Serial homology exhibited by teeth and appendages

5. Study of Homologous and Analogous organ

Animal Behaviour

1. Study of geo-taxis, photo -taxis , hydro- taxis in animals

2 Locomotory behaviors of dipterans larvae (Housefly/blowfly/fruitfully):

3. Locomotion on different types of substrata (writing paper, plastic sheet and sand paper

4.Study of bee hive and mound of termites

Recommended Books

Genetics

1. Brooker: Genetics : Analysis and Principles (1999, Addison-Wesley,)
2. Gardner *et al*: Principles of Genetics (1991, John Wiley)
3. Griffith *et al*: An Introduction to Genetic Analysis (2005, Freeman)
4. Hartl & Jones: Essential Genetics: A Genomic Perspective (2002, Jones & Bartlet)
5. Russell: Genetics (2002, Benjamin Cummings)
6. Snustad & Simmons: Principles of Genetics (2006, John Wiley)
7. Lewin: Genes IX (2008, Jones & Bartlett)

Evolution

1. Moody: Introduction to Evolution (1978, Kalyani).
2. Savage: Evolution (1963, Holt, Reinhart and Winston)
3. Rastogi: Organic Evolution (1988, Kedarnath & Ramnath)
4. Strickberger: Evolution (2004, Jones & Bartlett)

Animal Behaviour

1. Drickamer & Vessey : Animal Behaviour – concepts, processes and methods (2nd ed. 1986, Wadsworth,)
2. Freeland: Problems in Practical Advanced Level Biology (1985, Hodder & Stoughton,)
3. Goodenough et al.: Perspectives on Animal Behaviour (1993, Wiley)
4. Grier: Biology of Animal Behaviour (1984, Mosby)
5. Lorenz: The Foundation of Ethology (1981, Springer)
6. Manning & Dawkins: An Introduction to Animal Behaviour (5th ed. 1998, Cambridge).
7. Mcfarland : Animal Behaviour, Psychology, Ethology and Evolution (1985, Pitman).
8. Slater: An Introduction to Ethology (1985, Cambridge).

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. Honours in Zoology

Vth SEMETER

CZOOL-11 Microbiology & Immunology	Credit 4
CZOOL-12 Environmental biology	Credit 4
CZOOP – 5	Credit 4
DSE-1 Economic Zoology	Credit 4
DSE-2 Biostatistics	Credit 4
DSE P-1	Credit 4

B.Sc. Zoology Honours .
Semester V
CZOOL-11 Microbiology & Immunology

Full Marks 70

Credit 4

Microbiology

UNIT-1. Microbial diversity

2.1 Viruses
2.2. Bacteria
2.3. Eukaryotic microorganisms

UNIT-2. Techniques in microbiology

2.1. Classification of bacteria based on staining of microbes

UNIT-3. Pathogenic microbes

3.1 Mycobacterium
3.2 HIV

UNIT-4. Applied microbiology

4.1 Vaccine and its preparation
4.2 Antibiotic and sensitivity

Immunology

UNIT-1 . Introduction to Immunity

UNIT-2. Cell and organs of immune system

2.1 Types of immune cells, lymphoid and myeloid
2.2 Primary and secondary lymphoid organs .

UNIT-3. Humoral immunity

3.1 Antigen
3.2. Function of B cell

UNIT- 4. Cell mediated immunity

4 .1.Function of T-Cells

CZOOL-12 Environmental Biology

Full Marks 70
Credit 4

UNIT- 1. General concepts

1.1 Introduction to environmental biology
1.2 Components of ecosystem
1.3 Major ecosystems in world
1.4 Energy flow in ecosystem
1.5 food chain and food web
1.6 Bio- Geochemical cycle(C, N, and P)
    1.6.1 Water Cycle
    1.6.2 Gaseous Cycles- Carbon and Nitrogen
    1.6.3 Sedimentary Cycle- Phosphorous and sulphur

UNIT- 2. Population and communities

2.1 Population characteristics density, natality, mortality age pyramid and growth curve
2.2.Ecological succession and concept of climax

UNIT- 3. Pollution

3.1 Sources and impact of environmental pollutants- air, water and soil
3.2 Global environmental changes- greenhouse gases and their effects
3.3 Acid Rains

UNIT- 4. Natural resources

4.1. Soil, water, mineral resources and their conservation
4.2. Biodiversity- benefits, hotspots, threats and conservation

Recommended Books

Environmental Biology

1. Cunningham and Cunningham: Environmental Science (2003, McGraw Hill)
2. Odum: Fundamental of Ecology (1971, Saunders)
3. Raven, Berg and Jhonson: Environment (1993, Saunders)
4. Ricklefs: Ecology (1990, Freeman)
5. Sharma: Ecology and Environment (2003, Rastogi)
6. Turk and Turk: Environmental Science (1998, Saunders)

DSE-1 :- Economic Zoology

Full Marks 70
Credit 4

Unit 1: Bee-keeping and Bee Economy (Apiculture)

Varieties of honey bees and Bee pasturage; Setting up an apiary
Rearing equipments, handling of bees, artificial diet; Diseases of honey bee, American and Honey extraction techniques; Physico-chemical analysis of honey; Other beneficial products from bee;

Unit 2: Silk and Silk Production (Sericulture)

Different types of silk and silkworms in India; Rearing of *Bombyx mori* – Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages, harvesting of cocoons; Silkworm pests and parasites: Uzi fly,
Dermestid beetles, and their management; Silk reeling techniques; Quality assessment of silk fibre

Unit 3: Aquaculture

Brood stock management; Induced breeding of fish and prawn; Management of hatchery of fish; Management of nursery, rearing and stocking ponds; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish; Fishery by-products

Unit 4: Dairy/Poultry Farming

Introduction; Indigenous and exotic breeds; Rearing, housing, feed and rationing; Commercial importance of dairy and poultry farming; Dairy/poultry farm management; Visit to any Dairy farm/Poultry farm

* Submission of report on anyone field visits mentioned above

SUGGESTED READINGS

1. Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.

2. Sericulture, *FAO Manual of Sericulture.*

3. Hafez, E. S. E. (1962). *Reproduction in Farm Animals*, Lea and Fabiger Publishers.

4. Srivastava, C. B. L. (1999). *Fishery Science and Indian Fisheries*. Kitab Mahal publications, India.

5. Sardar Singh, *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.45

6. Dhyan Singh Bisht, *Apiculture*, ICAR Publication.

7. Knobil, E. and Neill, J. D. (2006). *The Physiology of Reproduction*, Vol. 2, Elsevier Publishers.

8. Dunham R. A. (2004). *Aquaculture and Fisheries Biotechnology - Genetic Approaches.* CABI publications, U.K.

DSE-2 :-Biostatistics

Full Marks 70
Credit 4

UNIT-1 Data

1.1 primary Data
1.2Secondary data
1.3 Frequency distribution and tally marks

UNIT-2.Data presentation

2.1 Diagrammatic: Histogram and Pie Diagram
2.2 Graphical

UNIT-3. Measurement of central tendency

3.1. Mean
3.2 Median
3.3 Mode

UNIT-4. Measurment of Variation

4.1 standard deviation
4.2 standard error

UNIT-5. Test of Significance

5.1 student 't 'test

PRACTICAL BASED ON DSE :- 1 & DSE :- 2
DSEP-1

Full Marks 60
Credit 4

DSE-1 : - Economic Zoology

1. Report on field Visit to sight of sericulture, Apiculture, Lac Culture and Aquaculture
2. Study of Paddy pests, Pest of Sugar cane
3. Study of some economically Important fishes

DSE-2 :-Biostatistics

1. Determination of mean, median & mode
2. Determination of Deviation
3. Graphical representation of statistical data

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM
B.Sc Honours in Zoology
VIth SEMETER

CZOOL-13 Molecular Biology & Biotechnology Credit 4

CZOOL-14 Medical and Applied Zoology Credit 4

CZOOP-6 Credit 4

DSE-3 Toxicology Credit 4

DSE-4 Project Credit 6

DSEP-2 Credit 2

Semester VI

CZOOL-13 Molecular Biology & Biotechnology

Full Marks 70

Credit 4

UNIT-1. Nucleic Acids

1.1 Conformations of DNA(A, B and Z)
1.2 Mechanism of DNA replication
1.3 Mechanism of transcription in Prokaryotes
1.4 Mechanism of translation in prokaryotes

UNIT 2. Gene Regulation

2.1 Concepts of operon
2.3 Iac operon,
2.4 trp operon,

UNIT-3. Biotechnology

3.1. Tools: Restriction enzymes, Vectors
3.2. DNA fingerprinting

CZOOL-14 Medical and Applied Zoology

Full Marks 70

Credit 4

UNIT-1 Life Cycle, Pathogenicity , clinical features, prophylaxis and control of pathogenic protozoan

1.1 Plasmodium
1.2 Entamoeba histolytica
1.3 Leishmania donovani

UNIT-2 Pathogenic Helminthes parasites ,clinical Features ,Control and prophylaxis

2.1 Fasciola sp.
2.2. Wuchereria
2.3. Ascaries

UNIT-3 Vector Biology

3.1 Mosquito (Anopheles Female), Yellow Fever ,Dengue Fever,(Aedes)Filariasis (Culex Female) Japanese encephalitis
3.2 Plague

UNIT-4 Non Vector Diseases

4.1Typhoid
4.2 Cholera
4.3 Small pox

UNIT-5 General Account of Vaccine & Vaccination, Eradication Programme , drug Therapy .

Practical based on CZOOL-13 & CZOOL-14
CZOOP-6

Full Marks 60

Credit 4

Molecular biology & Biotechnology

1. Demonstration of DNA separation on Gel
2. Use of micropipette
3. Protein estimation by Colorimeter
4. test of bio molecules : Carbohydrate, Protein and lipids

1. Physical examination of urine
2. Blood film preparation
3. Determination of Bleeding and clotting time
4. Glucose presence in Urine and serum
5. Slide / museum specimens of parasites
6. Study of specimens of common pests

Books Recommended

Molecular biology & Biotechnology

1. B.D.Singh – A Text book of biotechnology

2.. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
3. Karp: Cell and Molecular Biology (2008, John Wiley)
4. Lodish *et al*: Molecular Cell Biology (2008, Freeman)

Immunology

1. Abbas et al: Cellular and Molecular Immunology (2001, Saunders)
2. Alberts et al: Molecular Biology of the Cell (5th ed. 2008, Garland)
3. Kuby: Immunology (2003, Freeman)
4. Roitt and Delvis: Roitt's Essential Immunology (6th ed. 2006, Blackwell)

Microbiology

1. Madigan and Martinko: Brock Biology of Microorganisms (2006, Prentice Hall)
2. Prescott, Harley and Klein: Microbiology (1999, McGraw)
3. Pelzar – Microbilogy

DSE-3:- Toxicology

(CREDITS: THEORY-4, PRACTICALS- 2)

Full Marks 70
Credit 4

UNIT :- 1 Environmental Pollution :-
Air , water , soil and their control Strategies .

UNIT :- 2 . Environmental toxicology :-

Introduction , definition , classification , toxic agent (food additives ,pesticides , metals , carcinogens and poisons) , xenobiotics .

UNIT :- 3. Statistical method in toxicology , applications of toxicology (assessment of Lc 50, LD 50)

UNIT :- 4.
4.1.Environmental Impact assessment .
4.2. Environmental Policy .

DSE-4:- Project work

Full Marks 100

Credit-6

The objective of this paper is to inculcate the trait of independent investigation , the student shall work (approximately 60 study hours) on some topic related to his / her area of specialiazation or related to his / her broader area of study . He / she shall write a project report preferably independently or in association with faculty members of the Department .

Two examiners shall evaluate the project . a written test one hour duration relating to the project shall be taken .

MARKS DISTRIBUTION

- Project Preparation through Power Point 40
- Written Test 40
- Viva - Voce 20

PRACTICAL BASED ON DSE :- 3

Full Marks 30
Credit :- 2

DSE-3 PRACTICALS

1. Identification of flora, mammalian fauna, avian fauna,
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range finders, GPS, various types of cameras and lenses)
3. Familiarization and study of animal evidences in the field, identification of animals through pug marks, hoof marks, scats, pellet groups, nest ant etc.
4. Estimating methods of flora and fauna