



**List of Courses Focus on Employability/ Entrepreneurship/  
Skill Development**

**Department : Zoology**

**Programme Name : B. Sc**

**Academic Year : 2019-20**

**List of Courses Focus on Employability/ Entrepreneurship/Skill Development**

Sr. No.	Course Code	Name of the Course
1.	LS/ZOO/CC-101 L	Non-Chordates I: Protista to Pseudocoelomata
2.	LS/ZOO/CC-101 P	Lab Course
3.	LS/ZOO/CC-102 L	Principles of Ecology
4.	LS/ZOO/CC-102 P	Lab Course
5.	LS/ZOO/GE-101 L	Aquatic Biology (Practical)
6.	LS/ZOO/GE-101 P	Lab Course
7.	LS/ZOO/CC-201 L	Non Chordates-II (Coelomates)
8.	LS/ZOO/CC-201 P	Lab Course
9.	LS/ZOO/CC-202 L	Cell Biology
10.	LS/ZOO/CC-202 P	Lab Course
11.	LS/ZOO/GE-201 L	Environment and Public Health
12.	LS/ZOO/GE-201 P	Lab Course
13.	LS/ZOO/CC-301 L	Diversity of Chordates
14.	LS/ZOO/CC-301 P	Lab Course
15.	LS/ZOO/CC-302 L	Physiology: Controlling and Coordinating Systems
16.	LS/ZOO/CC-302 P	Lab Course
17.	LS/ZOO/CC-303 L	Fundamentals of Biochemistry
18.	LS/ZOO/CC-303 P	Lab Course
19.	LS/ZOO/GE-301 L	Food Nutrition and Health
20.	LS/ZOO/GE-301 P	Lab Course
21.	LS/ZOO/SEC-301 P	Sericulture
22.	LS/ZOO/SEC-302 L	Lab Course
23.	LS/ZOO/CC-401 L	Comparative Anatomy of Vertebrates
24.	LS/ZOO/CC-401 P	Lab Course

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25.	LS/ZOO/CC-402 L	Physiology: Life Sustaining Systems
26.	LS/ZOO/CC-402 P	Lab Course
27.	LS/ZOO/CC-403 L	Biochemistry of Metabolic Processes
28.	LS/ZOO/CC-403 P	Lab Course
29.	LS/ZOO/GE-401 P	Insect Vectors and Diseases
30.	LS/ZOO/GE-402 L	Lab Course
31.	LS/ZOO/SEC-401 P	Medical Diagnostics
32.	LS/ZOO/SEC-402 L	Lab Course
33.	ZOO-501	Economic Zoology
34.	ZOO-502	Ecology and Evolution
35.	ZOO-503 Practical	Lab Course (501 + 502)
36.	ZOO-504 IDLS	Biostatistics and Computer Application
37.	ZOO-505(A/B/C/D/E)	(Biochemistry/ Endocrinology/ Fish Biology/ Neuroscience/Toxicology)
38.	ZOO-506 Practical	Lab Based on 504 and elective paper
39.	ZOO-601	Microbiology and Parasitology
40.	ZOO-602	Developmental Biology and Immunology
41.	ZOO-603 Practical	Lab Course (601+ 602)
42.	ZOO-604	Biotechniques

*A. V. B. Bhargava*

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## Scheme and Syllabus

B.Sc. Hon's (Zoology): CBCS 2018-2019

School of Life Sciences

Semester I				
Course Opted	Course Code	Name of the course	Credit	H/week
Core Course-1 Theory	LS/ZOO/CC-101 L	Non Chordates - I (Protozoa to Pseudocoelomate)	4	4
Core Course-1 Practical	LS/ZOO/CC-101 P	Lab Course	2	4
Core Course-2 Theory	LS/ZOO/CC-102 L	Principles of Ecology	4	4
Core Course-2 Practical	LS/ZOO/CC-102 P	Lab Course	2	4
Generic Elective-1 Theory	LS/ZOO/GE-101 L	Aquatic Biology	4	4
Generic Elective-1 Practical	LS/ZOO/GE-101 P	Lab Course	2	4
Ability Enhancement Compulsory Course-1	LS/ZOO/AE-101/EC	English Communication / MIL (Hindi Communication)	4*	4
Extracurricular activity		Tour, Field visit/ Industrial training/ NSS/ Swachhta/ Vocational Training/ Sports/ others	2	(2)
<b>TOTAL</b>			<b>24</b>	<b>28</b>
Semester II				
Core Course-3 Theory	LS/ZOO/CC-201 L	Non Chordates - II (Coelomates)	4	4
Core Course-3 Practical	LS/ZOO/CC-201 P	Lab Course	2	4
Core Course-4 Theory	LS/ZOO/CC-202 L	Cell Biology	4	4
Core Course-4 Practical	LS/ZOO/CC-202 P	Lab Course	2	4
Generic Elective-2 Theory	LS/ZOO/GE-201 L	Environment and Public Health	4	4
Generic Elective-2 Practical	LS/ZOO/GE-201 P	Lab Course	2	4
Ability Enhancement Compulsory Course-2	LS/ZOO/AE-201/ES	Environmental Science	4*	4
Extracurricular activity		Tour, Field visit/ Industrial training/ NSS/ Swachhta/ vocational Training/ Sports/ others	2	(2)
<b>Total</b>			<b>24</b>	<b>28</b>
Summer Internship: 15 days		Swayam Swachhta / NSS / Industrial/ others	1	100
Semester III				
Core Course-5 Theory	LS/ZOO/CC-301 L	Diversity of chordates	4	4
Core Course-5 Practical	LS/ZOO/CC-301 P	Lab Course	2	4
Core Course-6 Theory	LS/ZOO/CC-302 L	Physiology: Controlling and Coordinating systems	4	4
Core Course-6 Practical	LS/ZOO/CC-302 P	Lab Course	2	4
Core Course-7 Theory	LS/ZOO/CC-303 L	Fundamentals of Biochemistry	4	4
Core Course-7 Practical	LS/ZOO/CC-303 P	Lab Course	2	4
Generic Elective-3 Theory	LS/ZOO/GE-301 L	Food Nutrition and Health	4	4
Generic Elective-3 Practical	LS/ZOO/GE-301 P	Lab Course	2	4
Skill Enhancement Course-1	LS/ZOO/SEC-301 L	Sericulture	2	4
Skill Enhancement Course-1	LS/ZOO/SEC-301 P	Lab Course	2	4
<b>Total</b>			<b>28</b>	<b>34</b>
Semester IV				
Core Course-8 Theory	LS/ZOO/CC-401 L	Comparative anatomy of vertebrates	4	4
Core Course-8 Practical	LS/ZOO/CC-401 P	Lab Course	2	4
Core Course-9 Theory	LS/ZOO/CC-402 L	Physiology: Life Sustaining Systems	4	4
Core Course-9 Practical	LS/ZOO/CC-402 P	Lab Course	2	4
Core Course-10 Theory	LS/ZOO/CC-403 L	Biochemistry of Metabolic Processes	4	4



Core Course-10 Practical	LS/ZOO/CC-403 P	Lab Course	2	4
Generic Elective-4 Theory	LS/ZOO/GE-401 L	Insect Vectors and Diseases	4	4
Generic Elective-4 Practical	LS/ZOO/GE-401 P	Lab Course	2	2
Skill Enhancement Course-2	LS/ZOO/SE-401	Medical Diagnostics	2	4
Skill Enhancement Course-2	LS/ZOO/SE-401	Lab Course	2	4
<b>TOTAL</b>			<b>18</b>	<b>34</b>
Summer internship: 15 days			2	100
Swayam Swachhita / NSS / Industrial/ others				
<b>Semester V</b>				
Core Course-11 Theory	LS/ZOO/CC-501 L	Molecular Biology	4	4
Core Course-11 Practical	LS/ZOO/CC-501 P	Lab Course	2	4
Core Course-12 Theory	LS/ZOO/CC-502 L	Principles of Genetics	4	4
Core Course-12 Practical	LS/ZOO/CC-502 P	Lab Course	2	4
Discipline Specific Elective-1 Theory	LS/ZOO/DSE-501(A) L LS/ZOO/DSE-501(B) L LS/ZOO/DSE-501(C) L	A. Basics of Neuroscience B. Endocrinology C. Immunology	4	4
Discipline Specific Elective-1 Practical	LS/ZOO/DSE-501(A) P LS/ZOO/DSE-501(B) P LS/ZOO/DSE-501(C) P	Lab Course A Lab Course B Lab Course C	2	4
Discipline Specific Elective-2 Theory	LS/ZOO/DSE-502(A) L LS/ZOO/DSE-502(B) L LS/ZOO/DSE-502(C) L	A. Animal Behavior and Chronobiology B. Parasitology C. Reproductive Biology	4	4
Discipline Specific Elective-2 Practical	LS/ZOO/DSE-502(A) P LS/ZOO/DSE-502(B) P LS/ZOO/DSE-502(C) P	Lab Course A Lab Course B Lab Course C	2	4
<b>TOTAL</b>			<b>24</b>	<b>32</b>
<b>Semester VI</b>				
Core Course-13 Theory	LS/ZOO/CC-601 L	Developmental Biology	4	4
Core Course-13 Practical	LS/ZOO/CC-601 P	Lab Course	2	4
Core Course-14 Theory	LS/ZOO/CC-602 L	Evolutionary Biology	4	4
Core Course-14 Practical	LS/ZOO/CC-602 P	Lab Course	2	4
Discipline Specific Elective-3 Theory	LS/ZOO/DSE-601(A) L LS/ZOO/DSE-601(B) L LS/ZOO/DSE-601(C) L	A. Biology of Insects B. Fish and Fisheries C. Wild Life Conservation and Management	4	4
Discipline Specific Elective-3 Practical	LS/ZOO/DSE-601(A) P LS/ZOO/DSE-601(B) P LS/ZOO/DSE-601(C) P	Lab Course A Lab Course B Lab Course C	2	4
Dissertation/ Project work / Academic Visit followed by report submission and seminar	LS/ZOO/DW/PW/AV		5+1=6	8
<b>TOTAL</b>			<b>24</b>	<b>32</b>
<b>TOTAL CREDITS</b>			<b>152 + 4 (SU)</b>	

As per UOC CDCS guidelines, University / departments have liberty to offer GE and SEC courses offered by any department to students of other departments. The No. of GE course is four. One GE course is compulsory in first 4 semesters each. In present scheme it is proposed to have minimum two GE courses (from one subject) in first two semester after which student shall change two GE for another subject in III<sup>rd</sup> and IV<sup>th</sup> semester, so that all the student can have exposure of one additional subject.  
(Subject to approval by the competent authority)

*Changela*  
External Expert

*Dr. Ronit Seth*  
Dr. Ronit Seth 06/07/18

*Santosh Singh*  
Santosh Singh  
06/07/18

*Mouli*  
Mouli  
06/07/18

Head of the Department

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Semester V:

Course type	Course Code	Title of Course	Credits	Hrs/ Wk	Hrs/ Sem
Zoology (H)	ZOO-501	Economic Zoology	3	3	
	ZOO-502	Ecology and Evolution	3	3	
	ZOO-503	Lab Course (501 + 502)	3	6	
	ZOO-504	Practical			
Discipline Specific Elective -I (DSE-I)	ZOO-505 (A/B/C/D/E)	Biostatistics and Computer Applications	3	3	
	ZOO-506	(Biochemistry/ Endocrinology/ Fish Biology/ Neuroscience/ Toxicology)	3	3	
	ZOO-506	Lab based on 504 and elective paper	3	6	
	ZOO-507	Seminar	3	3	
<b>Total Credits</b>			<b>21</b>		

Semester VI:

Course type	Course Code	Title of Course	Credits	Hrs/ Wk	Hrs/ Sem
Zoology (H)	ZOO-601	Microbiology and Parasitology	3	3	
	ZOO-602	Developmental Biology and Immunology	3	3	
	ZOO-603	Lab Course (601 + 602)	3	6	
	ZOO-604	Practical			
Discipline Specific Elective -II (DSE-II)	ZOO-DSE-2 (A/B/C/D/E)	Biotechniques	3	3	
	ZOO-DSE-3	(Biochemistry/ Endocrinology/ Fish Biology/ Neuroscience/ Toxicology)	3	3	
		Seminar on the basis of published research articles relevant to the topics covered in the elective paper	6	6	
<b>Total Credits</b>			<b>21</b>		

Note:

- Groups offered by the Department for Integrated UG/ PG students at entry level
  - Group I: Zoology, Chemistry and Botany (ZCB)
  - Group II: Zoology, Chemistry and Biotechnology (ZCBT)
- Codes of special papers  
A= Biochemistry; B= Endocrinology; C= Fish Biology; D= Neuroscience; E= Toxicology.

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Anthon

Sankar Singh  
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## CORE COURSE I

LS/ZOO/CC-101 L

### NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATA

#### THEORY

(Credits 4)

<b>Unit 1: Protista, Parazoa and Metazoa</b>	19
General characteristics and classification up to classes; Study of <i>Euglena</i> , <i>Amoeba</i> and <i>Paramecium</i> ; Life cycle and pathogenicity of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i> ; Locomotion and Reproduction in Protista; Evolution of symmetry and segmentation of Metazoa	
<b>Unit 2: Porifera</b>	7
General characteristics and classification up to classes; Type study of <i>Sycon</i> ; Canal system and spicules in sponges	
<b>Unit 3: Cnidaria</b>	12
General characteristics and classification up to classes; Type study of <i>Obelia</i> ; Polymorphism in Cnidaria; Corals and coral reefs	
<b>Unit 4: Ctenophora</b>	4
General characteristics and Evolutionary significance	
<b>Unit 5: Platyhelminthes</b>	10
General characteristics and classification up to classes; Type study, larval forms and pathogenicity of <i>Fasciola hepatica</i>	
<b>Unit 6: Nematelminthes</b>	8
General characteristics and classification up to classes; Type study of <i>Ascaris lumbricoides</i> ; Life cycle and pathogenicity of <i>Wuchereria bancrofti</i> ; Parasitic adaptations in helminthes	

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## CORE COURSE I

**LS/ZOO/CC-101 P**

### **NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATA**

#### **PRACTICALS**

(Credits 2)

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramecium*, Binary fission and Conjugation in *Paramecium*
2. Examination of pond water collected from different places for diversity in Protista
3. Study of *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*
4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*, *Meandrina*, *Madrepora*
5. One specimen/slide of any ctenophore
6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/microphotographs)
7. Study of adult *Ascaris lumbricoides* and its life stages (slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

#### **SUGGESTED READINGS**

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition, Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson

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## CORE COURSE II

LS/ZOO/CC-102 L

### PRINCIPLES OF ECOLOGY

#### THEORY

(Credits 4)

<b>Unit 1: Introduction to Ecology</b>	6
History of ecology; Autecology and synecology; Levels of organization; Laws of limiting factors-Liebig's law of minimum and Shelford's law of tolerance; Study of physical factors	
<b>Unit 2: Ecosystem</b>	12
Types of ecosystems with one example in detail; Trophic levels; Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains; Food web; Energy flow through ecosystem; Ecological pyramids and Ecological efficiencies; Nutrient and biogeochemical cycle (nitrogen cycle); Human modified ecosystem	
<b>Unit 3: Population</b>	18
Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age and sex ratio, dispersal and dispersion, Exponential and logistic growth, equation and patterns, r and k strategies; Population regulation-density-dependent and independent factors; Population interactions;	
<b>Unit 4: Community</b>	10
Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological Succession, Types of Succession, Theories pertaining to climax community	
<b>Unit 5: Human impact on environment</b>	10
Environmental Pollution: Air, water and noise pollution; Global environmental issues: Greenhouse effect, Acid rain, Global Warming, Ozone depletion.	
<b>Unit 6: Applied Ecology</b>	4
Ecology in Wildlife Conservation and Management	

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*Sandeep Singh*

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## CORE COURSE II

LS/ZOO/CC-102 P

### PRINCIPLES OF ECOLOGY

#### PRACTICALS

(Credits 2)

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO<sub>2</sub>
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

#### SUGGESTED READINGS

- Colinaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

Monika

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Santosh Singh

Shruti



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## GENERIC ELECTIVE COURSES

1<sup>st</sup> ZOO/GE-101 L

### AQUATIC BIOLOGY

THEORY

(Credits 4)

#### UNIT 1: Aquatic Biomes

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

#### UNIT 2: Freshwater Biology

**Lakes:** Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.

**Streams:** Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

#### UNIT 3: Marine Biology

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

#### UNIT 4: Management of Aquatic Resources

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD.

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## GENERIC ELECTIVE COURSES

LS/ZOO/GE-101 P

AQUATIC BIOLOGY

PRACTICALS

(Credits 2)

1. Determine the area of a lake using planimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant/Marine bioreserve/ Fisheries Institutes.

### SUGGESTED READINGS

- Anathakrishnan : Bioresources Ecology 3rd Edition
- Goldman : Limnology, 2nd Edition
- Odum and Barrett : Fundamentals of Ecology, 5th Edition
- Pawlowski: Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
- Wetzel : Limnology, 3rd edition
- Trivedi and Goyal : Chemical and biological methods for water pollution studies
- Welch : Limnology Vols. I-II

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### CORE COURSE III

LS/ZOO/CC-201 I.

#### NON-CHORDATES II: COELOMATA

THEORY

(Credits 4)

<b>Unit 1: Introduction to Coelomates</b>	2
Evolution of coelom and metamerism	
<b>Unit 2: Annelida</b>	10
General characteristics and Classification up to classes; Type study of <i>Pheretima</i>	
<b>Unit 3: Arthropoda</b>	17
General characteristics and Classification up to classes; Type study of <i>Periplaneta</i> ; Vision and Respiration in Arthropoda; Larval forms in Arthropoda; Metamorphosis in Insects; Social life in bees and termites.	
<b>Unit 4: Onychophora</b>	4
General characteristics and Evolutionary significance with special reference to <i>peripatus</i>	
<b>Unit 5: Mollusca</b>	15
General characteristics and Classification up to classes; Type study of <i>Pila</i> ; Respiration in Mollusca; Torsion and detorsion in Gastropoda; Pearl formation in bivalves; Evolutionary significance of trochophore larva	
<b>Unit 6: Echinodermata</b>	12
General characteristics and Classification up to classes; Type study of <i>Asterias</i> ; Water-vascular system in Asteroidea; Larval forms in Echinodermata; Affinities with Chordates	

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### CORE COURSE III

LS/ZOO/CC-201 P

#### NON-CHORDATES II: COELOMATA

#### PRACTICALS

(Credits 2)

1. Study of following specimens:

**Annelids** - *Aphrodite*, *Nereis*, *Heteronereis*, *Sabella*, *Serpula*, *Chaetopterus*,  
*Pheretima*, *Hirudinaria* etc **Arthropods** - *Limulus*, *Palamnaeus*, *Palaeomon*, *Daphnia*,  
*Balanus*, *Sacculina*, *Cancer*, *Esopagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta*,  
termites and honey bees etc **Onychophora** - *Peripatus*

**Molluscs** - *Chiton*, *Dentalium*, *Pila*, *Doris*, *Helix*, *Unio*, *Ostrea*, *Pinctada*, *Septa*,  
*Octopus*, *Nautilus* etc **Echinodermates** - *Pentaceros*/*Asterias*, *Ophiura*, *Chyocaster*,  
*Echinus*, *Cucumaria* and *Antedon* etc

2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm

3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm

4. Mount of mouth parts and dissection of digestive system and nervous system of  
*Periplaneta*

5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc  
and echinoderm)

#### SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition
- Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*, II Edition, E.L.B.S. and Nelson
  - Nigam: Biology of Chordates (1997, S.Chand)
- Kotpal : Modern text book of Zoology: Vertebrates (Rastogi Publication)

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## CORE COURSE IV

LS/ZOO/CC-202 I

### CELL BIOLOGY

THEORY

(Credits 4)

<b>Unit 1: Overview of Cells</b>	8
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions, Cell Theory.	
<b>Unit 2: Plasma Membrane</b>	12
Various models of plasma membrane, Structure And Function of Plasma Membrane. Transport across membranes: Active and Passive transport, Facilitated transport. Cell junctions: Tight junctions, Desmosomes, Gap junctions	
<b>Unit 3: Cellular Organelles And Endomembrane System</b>	12
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Peroxisomes. Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis.	
<b>Unit 4: Cytoskeleton</b>	8
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
<b>Unit 5: Nucleus</b>	10
Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus. Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome). Giant Chromosomes: Polytene And Lampbrush	
<b>Unit 6: Cell division and Signaling</b>	10
Mitosis, Meiosis, Cell cycle and its regulation. GPCR and Role of second messenger (cAMP)	

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## CORE COURSE IV

LS/ZOO/CC-202 P

### CELL BIOLOGY

#### PRACTICALS

(Credits 2)

1. Familiarization with the student's Light and dissecting Microscope.
2. Staining of cell and different organelles (nucleus, mitochondria and chromosomes).
3. Permeability of Plasma membrane - effect of isotonic, hypertonic solution.
4. Mitosis in onion root tips and permanent slide and chart.
5. Meiosis in grasshopper testis (from slides/photographs provided) and permanent slide.
6. Study of Polytene chromosomes in Chironomous larva.
7. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.

#### SUGGESTED READINGS

- Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Lewis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc. New York and London.
- P K Gupta: Cell Biology
- Lodish et al: Molecular Cell Biology (2008, Freeman

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## GENERIC ELECTIVE COURSES

LS700/GE-201 L

### ENVIRONMENT AND PUBLIC HEALTH

THEORY

(Credits 4)

#### Unit 1: Introduction

Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment.

#### Unit 2: Climate Change

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health.

#### Unit 3: Pollution

Air, water, noise pollution sources and effects, Pollution control

#### Unit 4: Waste Management Technologies

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Bhopal disaster and Three Mile Island accident and their aftermath.

#### Unit 5: Diseases

Causes, symptoms and control of Tuberculosis, Asthma, Cholera, Minamata disease, typhoid

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## GENERIC ELECTIVE COURSES

LS/ZOO/GE-201 P

### ENVIRONMENT AND PUBLIC HEALTH

PRACTICALS

(Credits 2)

1. To determine Ph in soil and water samples from different locations.
2. To determine Cl in soil and water samples from different Locations
3. To determine SO<sub>4</sub> in soil and water samples from different Locations
4. To determine NO<sub>3</sub> in soil and water samples from different Locations
5. To determine BOD in water samples from different locations

#### SUGGESTED BOOKS

- Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pilblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
- Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
- Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V.N. University Press, New York, 2003.
- Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.

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## CORE COURSE V

LS/ZOO/CC-301 I.

### DIVERSITY OF CHORDATA

#### THEORY

(Credits 4)

<b>Unit 1: Introduction and origin of Chordates</b>	5
General characteristics and outline classification, Dipleurula concept and the Echinoderm theory of origin of chordates, Advanced features of vertebrates over protochordates.	
<b>Unit 2: Zoogeography</b>	8
Zoogeological time scale, Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, Distribution of vertebrates in different realms.	
<b>Unit 3: Protochordata</b>	8
General characteristics of Hemichordata, Urochordata and Cephalochordata, Study of larval forms in Protochordates, Retrogressive metamorphosis in Urochordata.	
<b>Unit 4: Agnatha and Pisces</b>	10
General characteristics and classification of cyclostomes up to orders; General characteristics of Chondrichthyes and Osteichthyes and Classification up to orders, Migration, Osmoregulation and Parental care in fishes.	
<b>Unit 5: Amphibia and Reptilia</b>	13
Origin of Tetrapoda (Evolution of terrestrial ectotherms), General characteristics and classification of Amphibia up to orders, Parental care in Amphibians; General characteristics and classification of Reptilia up to orders, Affinities of <i>Sphenodon</i> , Poison apparatus and Biting mechanism in snakes.	
<b>Unit 6: Aves and Mammalia</b>	16
General characteristics and classification of Aves up to orders, <i>Archaeopteryx</i> - a connecting link; Principles and aerodynamics of flight, Flight adaptations, and Migration in birds; General characters and classification of Mammalia up to orders, Affinities of Prototheria, Adaptive radiation in mammals with reference to locomotory appendages.	

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## CORE COURSE V

LS/ZOO/CC-301 P

### DIVERSITY OF CHORDATA

#### PRACTICALS

(Credits 2)

#### 1. Protochordata

*Balanoglossus, Herdmania, Branchiostoma*, Colonial Vertebrata, Sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Asymphysa* through pharyngeal, intestinal and caudal regions, Permanent slide of *Herdmania* spicules.

#### 2. Agnatha and Fishes

*Petromyzon, Myxine, Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mysus, Heteropneustes, Labes, Catla, Cirrhinus, Exocoetus, Echeatis, Anguilla, Hippocampus, Tetradon, Diodon, Anabas*, Flat fish.

#### 3. Amphibia and Reptilia

*Ichthyophis, Necturus, Rana, Bufo, Hyla, Alytes, Salamandra, Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophisaurus, Draco, Bungarus, Pteris, Naja, Hydrophis, Zamenis, Crocodylus*, Key for identification of poisonous and non-poisonous snakes.

#### 4. Aves and Mammalia

Study of common birds from different orders, Types of beaks and claws, *Sorex*, Bat (Insectivorous and Frugivorous), *Rattus, Funambulus, Loris, Herpestes, Erinaceus*, Mount of weberian ossicles of *Mysus*/pecten from Fowl head/Power point

#### SUGGESTED READINGS

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrimson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
- Dorit, Walker & Barnes: *Zoology*. Brooks Cole; 1 edition (February 15, 1991)
- Nigam: *Biology of Chordates* (1997, S.Chand)
- Kotpal : *Modern text book of zoology: Vertebrates* (Rastogi Publication)

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## CORE COURSE VI

LS/ZOO/CC-302 L

### ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

#### THEORY

(Credits 4)

<b>Unit 1: Tissues</b>	<b>6</b>
Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue	
<b>Unit 2: Bone and Cartilage</b>	<b>4</b>
Structure and types of bones and cartilages, Ossification, bone growth and resorption	
<b>Unit 3: Muscle</b>	<b>12</b>
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	
<b>Unit 4: Nervous System</b>	<b>10</b>
Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.	
<b>Unit 5: Endocrine System</b>	<b>18</b>
Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones	
<b>Unit 6: Reproductive System</b>	<b>10</b>
Histology of testis and ovary, Physiology of male and female reproduction; Puberty, Methods of contraception in male and female	

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## CORE COURSE VI

LS/ZOO/CC-302 P

### ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS

(Credits 2)

#### ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

##### PRACTICALS (Credits 2)

1. Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues
6. Study of eggs and tadpoles of frogs.
7. Study of whole mount preparation of chick embryo.

##### SUGGESTED BOOKS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations, XII Edition. Lippincott W. & Wilkins.

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**CORE COURSE VII**

**LS/ZOO/CC-303 L**

**FUNDAMENTALS OF BIOCHEMISTRY**

**THEORY**

**(Credits 4)**

**Unit 1: Biomolecules**

4

Chemistry of Living system: Scope and importance; Biomolecules: Organizational principle, Configuration and confirmation; Water as a biological solvent.

**Unit 2: Carbohydrates**

8

Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates

**Unit 3: Lipids**

8

Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

**Unit 4: Proteins**

14

Amino acids: Structure, Classification and General properties of  $\alpha$ -amino acids; Physiological importance of essential and non-essential  $\alpha$ -amino acids Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins

**Unit 5: Nucleic Acids**

12

Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA

**Unit 6: Enzymes**

14

Nomenclature and classification; Cofactors; Specificity of enzyme action; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of  $K_m$  and  $V_{max}$ , Lineweaver-Burk plot; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action

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## CORE COURSE VII

LS/ZOO/CC-303 P

### FUNDAMENTALS OF BIOCHEMISTRY

PRACTICALS

(Credits 2)

1. Qualitative tests of functional groups in carbohydrates: Benedict's test for reducing sugars, Iodine test for starch
2. Qualitative tests of proteins
3. Qualitative tests of lipids.
4. Paper chromatography of amino acids.
5. Action of salivary amylase under optimum conditions.
6. Effect of pH, temperature and inhibitors on the action of salivary amylase.
7. Structural study of DNA and RNA through models.

#### SUGGESTED READING

1. Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab Press, Pearson Pub.

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## GENERIC ELECTIVE COURSES

**LS/ZOOGF-301 L**

### FOOD, NUTRITION AND HEALTH

#### THEORY

(Credits 4)

<b>Unit 1: Basic concept of food and nutrition</b>	5
Food Components and food-nutrients Concept of a balanced diet, nutrient needs and dietary pattern for various groups	
<b>Unit 2: Nutritional Biochemistry:</b>	15
Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role Vitamins- Fat-soluble and Water-soluble vitamins- their dietary source and importance Minerals- Iron, calcium, phosphorus, iodine, selenium and zinc	
<b>Unit 3: Health-I</b>	10
Introduction to health- Definition and concept of health Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders	
<b>Unit 4: Health-II</b>	10
Life style related diseases- hypertension, diabetes mellitus and obesity- their causes and prevention through dietary and lifestyle modifications. Social health problems- smoking, alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS) - their causes, treatment and prevention Common ailments- cold, cough, and fevers, their causes and treatment	
<b>Unit 5: Food Hygiene-I</b>	10
Potable water- sources and methods of purification at domestic level Food and Water borne infections: Bacterial infection: Cholera, typhoid fever, dysentery, Viral infection: Hepatitis, Poliomyelitis,	
<b>Unit 6: Food Hygiene-II</b>	10
Protozoan infection: amoebiasis, giardiasis, Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention Brief account of food spoilage: Causes of food spoilage and their preventive measures	

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## GENERIC ELECTIVE COURSES

LS/ZOO/GE-301 P

FOOD, NUTRITION AND HEALTH

PRACTICALS

(Credits 2)

1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric
1. Estimation of Lactose in milk
4. Ascorbic acid estimation in food by titrimetry
5. Estimation of Calcium in foods by titrimetry
6. Study of the stored grain pests from slides/ photograph (*Stenophilus oryzae*, *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum*); their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.
7. Project- Undertake computer aided diet analysis and nutrition counseling for different age groups.  
OR Identify nutrient rich sources of foods (fruits and vegetables), their seasonal availability and price  
OR Study of nutrition labeling on selected foods

### SUGGESTED BOOKS

- Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
- Srilakshmi B. Nutrition Science; 2002; New Age International (P) Ltd.
- Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
- Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
- Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd. • Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill. • Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence. • Manry MS, Shodaksharaswamy. Food-Facts and Principles; 1998; New Age International (P) Ltd. • Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing

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## SKILL ENHANCEMENT COURSES

LS/ZOO/SEC-301 L

### SERICULTURE

#### THEORY

(Credits 4)

<b>Unit 1: Introduction</b>	5
Sericulture: Definition, history and present status; Types of silkworms: Exotic and indigenous species. Mulberry and non-mulberry sericulture.	
<b>Unit 2: Biology of Silkworm</b>	10
Life cycle of <i>Bombyx mori</i> ; Structure of silk gland and secretion of silk.	
<b>Unit 3: Rearing of Silkworms</b>	15
Selection of mulberry variety and establishment of mulberry garden; Rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder, RKO. Silkworm rearing technology: Early age and Late age rearing, Types of mountages, Spinning, harvesting and storage of cocoons.	
<b>Unit 4: Silkworm Genetics and Breeding</b>	10
Genetic variability in mulberry – sources of variability Wild species – hybrids. Popular varieties of India - chromosomal variations. Selection – characters and importance of a) pure line selection b) clonal selection c) mass selection.	
<b>Unit 5: Pests and Diseases</b>	10
Pests of silkworm: Uzi fly, dermestid beetles and vertebrates. Protozoan, viral, fungal and bacterial diseases. Control and prevention of pests and diseases.	
<b>Unit 6: Entrepreneurship in Sericulture</b>	10
Prospects of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.	

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## SKILL ENHANCEMENT COURSES

LS/ZOO/SEC-301 P

SERICULTURE

PRACTICALS

(Credits 2)

1. Study of different specimen and cocoon.
2. Study of mouth parts and silk gland.
3. Study of insect wings and their venation in adult worm.
4. Study of various diseases.
5. Study of any three beneficial insects and their products.

### SUGGESTED READINGS

- Manual on Sericulture; Food and Agriculture Organization, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhan CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Str. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhan, CSB, Bangalore 1988.
- Silkworm Rearing: Wuyang—Chan and Chen Do-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaiah, reprinted CSB, Bangalore, 1986.

### SUGGESTED ACTIVITY

Visit to local sericulture units.

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**CORE COURSE VIII**

**LS/ZOO/CC-401 I.**

**COMPARATIVE ANATOMY OF VERTEBRATES**

**THEORY**

**(Credits 4)**

<b>Unit 1: Integumentary and Skeletal System</b>	14
Structure, functions and derivatives of integument; Overview of axial and appendicular skeleton; Jaw suspensorium; Visceral arches; Vertebrae	
<b>Unit 2: Digestive and Respiratory System</b>	14
Alimentary canal and associated glands; dentition; Skin, Gills, Lungs and air sacs; Accessory respiratory organs	
<b>Unit 3: Circulatory System</b>	8
General plan of circulation; Evolution of heart and aortic arches; Portal systems	
<b>Unit 4: Urinogenital System</b>	8
Succession of kidney; Evolution of urinogenital ducts; General plan of gonads; Accessory reproductive organs; Types of mammalian uteri	
<b>Unit 5: Nervous System</b>	8
Comparative account of brain; Autonomic nervous system; Spinal cord; Cranial nerves in mammals;	
<b>Unit 6: Sense Organs</b>	8
Classification of receptors, Brief account of visual and auditory receptors in human	

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

**CORE COURSE VIII**

**LS/ZOO/CC-401 P**

**COMPARATIVE ANATOMY OF VERTEBRATES**

**PRACTICALS**

**(Credits 2)**

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit
3. Carapace and plastron of turtle/tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
6. Project on skeletal modifications in vertebrates

**SUGGESTED READINGS**

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution - IV Edition. McGraw-Hill Higher Education
- Keil, U.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates - IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
- Walter, H.E. and Sayles, L.P, Biology of Vertebrates, Khosla Publishing House

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## CORE COURSE IX

LS/ZOO/CC-402 L

### ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

#### THEORY

(Credits 4)

<b>Unit 1: Integumentary system</b>	<b>6</b>
Cell junction, epithelial and connective tissue, structure, type and function of skin, accessory structure of skin	
<b>Unit 2: Digestion</b>	<b>14</b>
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; Hormonal control of secretion of enzymes in Gastrointestinal tract.	
<b>Unit 3: Respiration</b>	<b>10</b>
Histology 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; Carbon monoxide poisoning; Control of respiration	
<b>Unit 4: Renal Physiology</b>	<b>12</b>
Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance	
<b>Unit 5: Blood</b>	<b>8</b>
Components of blood and their functions; Structure and functions of haemoglobin Haemostasis: Blood clotting system, Complement system and fibrinolytic system, Haemopoiesis Blood groups: Rh factor, ABO and MN	
<b>Unit 6: Physiology of Heart</b>	<b>10</b>
Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its	

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## CORE COURSE IX

LS/ZOO/CC-402 P

### ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

#### PRACTICALS

(Credits 2)

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of frog's heart beat under *in situ* and perfused conditions\*
6. Recording of blood pressure using a sphygmomanometer
7. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney through permanent slides.

#### SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). *Textbook of Medical Physiology*. XI Edition, Harcourt Asia PTE Ltd, W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). *Principles of Anatomy & Physiology*. XI Edition John Wiley & sons,
- Victor P. Eroschenko. (2008). *Ficer's Atlas of Histology with Functional correlations*. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). *Vander's Human Physiology: The Mechanism of Body Function*. XIII Edition, McGraw Hills

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## CORE COURSE IX

**LS/ZOO/CC-402 P**

### **ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS**

**PRACTICALS**

**(Credits 2)**

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of frog's heart beat under *in situ* and perfused conditions\*
6. Recording of blood pressure using a sphygmomanometer
7. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney through permanent slides.

#### SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## CORE COURSE X

LS/ZOO/CC-403 P

### BIOCHEMISTRY OF METABOLIC PROCESSES

#### PRACTICALS

(Credits 2)

1. Estimation of total protein in given solutions by Lowry's method.
2. Estimation of carbohydrate by toluene method.
3. Detection of SGOT and SGPT or GST and GSH in serum/ tissue.
4. Detection of GSH in serum/ tissue.
5. To study the enzymatic activity of Trypsin and Lipase /SOD and Catalase.
6. Study of biological oxidation (LPO) [Rat liver].
7. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.

#### SUGGESTED READINGS

1. Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## GENERIC ELECTIVE COURSES

LS/ZOO/GE-301 P

### FOOD, NUTRITION AND HEALTH

#### PRACTICALS

(Credits 2)

1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric
  3. Estimation of Lactose in milk
  4. Ascorbic acid estimation in food by titrimetry
  5. Estimation of Calcium in foods by titrimetry
  6. Study of the stored grain pests from slides/ photograph (*Sitophilus oryzae*, *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.
  7. Project- Undertake computer aided diet analysis and nutrition counseling for different age groups.
- OR Identify nutrient rich sources of foods (fruits and vegetables), their seasonal availability and price
- OR Study of nutrition labeling on selected foods

#### SUGGESTED BOOKS

- Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
- Srilakshmi B. Nutrition Science; 2002; New Age International (P) Ltd.
- Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
- Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
- Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd. • Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill. • Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence. • Manay MS, Shadaksharaswamy. Food-Facts and Principles; 1998; New Age International (P) Ltd. • Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## SKILL ENHANCEMENT COURSES

LS/ZOO/SEC-301 P

### SERICULTURE

### PRACTICALS

(Credits 2)

1. Study of different specimen and cocoons.
2. Study of mouth parts and silk gland.
3. Study of insect wings and their venation in adult worm.
4. Study of various diseases.
5. Study of any three beneficial insects and their products.

### SUGGESTED READINGS

- Manual on Sericulture, Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

### SUGGESTED ACTIVITY

Visit to local sericulture units.

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## CORE COURSE X

LS/ZOO/CC-403 L

### BIOCHEMISTRY OF METABOLIC PROCESSES

THEORY

(Credits 4)

<b>Unit 1: Bioenergetics</b>	4
ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors	
<b>Unit 2: Overview of Metabolism</b>	6
Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; Intermediary metabolism and regulatory mechanisms	
<b>Unit 3: Carbohydrate Metabolism</b>	16
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis	
<b>Unit 4: Lipid Metabolism</b>	14
$\beta$ -oxidation and omega-oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis	
<b>Unit 5: Protein Metabolism</b>	10
Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids	
<b>Unit 6: Oxidative Phosphorylation</b>	10
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and uncouplers of Electron Transport System	

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

**CORE COURSE X**

**LS/ZOO/CC-403 P**

**BIOCHEMISTRY OF METABOLIC PROCESSES**

**PRACTICALS**

(Credits 2)

1. Estimation of total protein in given solutions by Lowry's method.
2. Estimation of carbohydrate by toluene method.
3. Detection of SGOT and SGPT or GST and GSH in serum/ tissue
4. Detection of GSH in serum/ tissue
5. To study the enzymatic activity of Trypsin and Lipase /SOD and Catalase
6. Study of biological oxidation (LPO) [Rat liver]
7. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.

**SUGGESTED READINGS**

1. Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Roalwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## GENERIC ELECTIVE COURSES

LS/ZOO/GE-401 L

### INSECT VECTORS AND DISEASES

#### THEORY

(Credits 4)

<b>Unit I: Introduction to Insects</b>	6
General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits.	
<b>Unit II: Insect Vectors</b>	14
Brief introduction of Carrier and Vectors (mechanical and biological vectors), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity; Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera.	
<b>Unit III: Diptera as Disease Vectors</b>	24
Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes; Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly; Study of house fly as important mechanical vector, Myiasis, Control of house fly.	
<b>Unit IV: Siphonaptera as Disease Vectors</b>	6
Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas.	
<b>Unit V: Siphunculata as Disease Vectors</b>	4
Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse.	
<b>Unit VI: Hemiptera as Disease Vectors</b>	6
Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures.	

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## GENERIC ELECTIVE COURSES

LS/ZOO/GE-401 P

### INSECT VECTORS AND DISEASES

#### PRACTICALS

(Credits 2)

1. Study of different kinds of mouth parts of insects.
2. Study of different kinds of legs of insects.
3. Study of following insect vectors through permanent slides/ photographs:  
*Aedes*, *Culex*, *Anopheles*, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phthirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica*, through permanent slides/ photographs.
4. Study of different diseases transmitted by above insect vectors through charts/models.

#### SUGGESTED READINGS

- Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK.
- Chapman, R.F. (1998). *The Insects: Structure and Function*. IV Edition, Cambridge University Press, UK.
- Pedigo L.P. (2002). *Entomology and Pest Management*. Prentice Hall Publication.
- Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Willey

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## SKILL ENHANCEMENT COURSES

LS/ZOO/SEC-401 L

### MEDICAL DIAGNOSTICS

#### THEORY

(Credits 4)

<b>Unit 1: Introduction to Medical Diagnostics and its Importance</b>	2
<b>Unit 2: Diagnostics Methods Used for Analysis of Blood</b> Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)	10
<b>Unit 3: Diagnostic Methods Used for Urine Analysis</b> Urine Analysis: Physical characteristics; Abnormal constituents	6
<b>Unit 4: Non-infectious Diseases</b> Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit	6
<b>Unit 5: Infectious Diseases</b> Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis	3
<b>Unit 6: Tumours</b> Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).	3

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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

## SKILL ENHANCEMENT COURSES

LS/ZOO/SEC-401 P

### MEDICAL DIAGNOSTICS

#### PRACTICAL

(Credits 2)

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Estimation of D.L.C., E.S.R, P.C.V.
6. Platelet count using haemocytometer, Erythrocyte
7. Recording of frog's heart beat under *in situ* and perfused conditions
8. Recording of blood pressure using a sphygmomanometer

#### SUGGESTED READINGS

- Park, K. (2007), *Preventive and Social Medicine*, B.B. Publishers
- Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology*, II Edition, Bhalani Publishing House
- Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*
- Guyton A.C. and Hall J.E. *Textbook of Medical Physiology*, Saunders
- Robbins and Cortan, *Pathologic Basis of Disease*, VIII Edition, Saunders
- Prakash, G. (2012); *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd.

#### SUGGESTED ACTIVITY

Visit to local hospital units.



Department of Zoology, GGV, Bilaspur (CG)

B.Sc. (Hon'rs) Zoology SEMESTER - V

ZOO-CC: 501

**ECONOMIC ZOOLOGY**

(Credits- 02)

**Unit 1: Aquaculture**

(06 hrs)

Fish culture, Importance of fish and their by-products; Prawn culture; Pearl culture.

**Unit 2: Sericulture**

(06 hrs)

Species of silk worms, their host plants, and types of silk, Life cycle of silk worm, Mulberry silk worm culture; Appliances used in sericulture, Stiffing, Disease.

**Unit 3: Apiculture**

(05 hrs)

Species of honey bees, Life history of honey bee, indigenous and modern techniques of apiculture, Bee products and their uses, Disease.

**Unit 4: Lac culture**

(04 hrs)

Morphology of Lac insect and its life cycle; Lac culture; Processing and uses of lac, Disease.

**Unit 5: Animal husbandry and Poultry**

(04 hrs)

Animal husbandry: Types of breeds of cows and buffaloes; Management of dairy animals.

Poultry: Types of breeds, Rearing methods, Diseases and control measures.

**Books Recommended**

1. Shukla and Upadhyaya : Economic Zoology (Rastogi Publishers, 1999-2000)
2. Shrivastava: Text book of Applied Entomology, Vol. I & II (Kalyani Publishers, 1991)
3. Mani: Insects, NBT, India, 2006.
4. Jabde: Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture, Agricultural Pests and their Control, 2005 Discovery Publishing House.
5. Jadhav U. Aquaculture Technology and Environment. PHI Learning. 2011.

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Department of Zoology, GGV, Bilaspur (CG)

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B.Sc. (Hon's) Zoology SEMESTER - V

ZOO-CC: 502

**ECOLOGY AND EVOLUTION**

**Unit 1: Ecosystem**

(Credits- 02)

(05 hrs)

Components of ecosystems, Ecological factors a) Abiotic: temperature and light & their effects on organisms. b) Biotic- Intraspecific & interspecific associations, Food chain, Food pyramids, Energy flow in the ecosystem

**Unit 2: Biodiversity and Conservation**

(05 hrs)

Biodiversity concept, types of biodiversity, biodiversity and human welfare, mega diversity zones and biodiversity hot spots with special reference to India. Concept of conservation, *in situ* and *ex-situ* methods, Environmental degradation (natural and man-made), Pollution: types, sources and effects of major pollutants of air, water, soil and noise, Control of pollution

**Unit 3: Population Ecology**

(04 hrs)

Natality & mortality, growth forms, age pyramids, dispersal, distribution types, regulation of population density, Community ecology: Characteristics, types, habitat & niche concept.

**Unit 4: Organic evolution**

(05 hrs)

Concept of organic evolution, Evidences of organic evolution from comparative anatomy, embryology, palaeontology, biochemistry and genetics; theories of organic evolution: Lamarckism, Darwinism, modern synthetic theory, natural selection in action (industrial melanism, antibiotic and DDT resistance).

**Unit 5: Population genetics**

(05 hrs)

Gene frequency in Mendelian population, Hardy-Weinberg equilibrium; major evolutionary forces: isolating mechanisms, modes of speciation (allopatric and sympatric).

**Books Recommended**

1. Ecology: Principles & Applications' Chapman J.L. & Reiss M.J. (1995) Cambridge University Press 3)
2. Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. (1997) WCB, Mcgraw Hill 4)
3. Environmental Science Tyler M.G. Jr. (1997) Wadsworth Publ. Co.
4. Environmental Studies Benny Joseph (2005) Tata McGraw Hill Publ. Co. Ltd.
5. Heywood, V.H. and Watson, R.T. Global Biodiversity Assessment. UNEP - Cambridge.
6. Gadgil, M., Ghate, U and Pramod, P. Biodiversity. Resource Material for Courses, Practical Exercises and student projects at college and universities.

**Evolution**

1. P A Moody: Introduction to Evolution;
2. Rastogi: Organic Evolution (2007, Kedarnath & Ramnath)
3. Strickberger: Evolution

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Department of Zoology, GGV, Bilaspur (CG)

4. B.Sc. (Hon's) Zoology SEMESTER V

ZOO- CC: 503

Practical (Credits- 02): Lab course based on 501 and 502

**ECONOMIC ZOOLOGY**

1. Study of permanent slides of different larvae of insects.
2. Study of specimens and models relevant to theory paper.
3. Study of life cycle of insects through chart/specimens
4. Study of external morphology of honey bee and dissection of sting apparatus of honey bee
5. Study of different types of antenna.
6. Field visit

**ENVIRONMENTAL BIOLOGY**

1. Ecological comments on charts/material (as per syllabus).
2. Collection and preservation of water and soil samples (Field Practical)
3. Determination of Total Hardness (Ca & Mg) from water.
4. Estimation of the Moisture Content & Water Holding Capacity of soil
5. Study of Animal Adaptations under various ecological conditions.
6. Preparation of field report based on the survey of local fauna

**EVOLUTION**

7. Frequency of following genetic trait in human attached ear lobe, widow's peak, dimple in chin, mid-digital Hair, Thumb, hypertrichosis, color blindness, PTC (phenyl thiocarbamide)
8. Study of mode of inheritance of the following traits by pedigree charts – attached ear lobe, widow's peak

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B.Sc. (Hon's) Zoology SEMESTER - V

IDLS PAPER

ZOO-CC: 504

**BIOSTATISTICS AND COMPUTER APPLICATIONS**

**Unit 1: Handling Data**

(05 hrs)

Collection of Data, Sampling Design, Classification and Tabulation, Graphical representation of data; Measures of central tendency: Mean, median and Mode and their merits and demerits.

**Unit 2: Basic analysis of data**

(05 hrs)

Measures of dispersion: Range, Mean deviation, Standard deviation, Standard error of mean, Correlation and Regression and their coefficients.

**Unit 3: Probability and Significance test**

(05 hrs)

Elementary idea of probability; Test of significance and calculations: Z-Test, Student t- test, Chi-square test and its significance

**Unit 4: Introduction to computer**

(04 hrs)

Generations of Computer, Basics of computers (CPU, I/O units), memory, computer software,

**Unit 5: Networking**

(05 hrs)

Networks (LAN, WAN) and Internet, Concept of hypertext and internet protocol (HTTP, TCP/IP), home-pages, web-pages and uniform resource locators (URL), Computer applications.

**Books Recommended**

1. James L. Bruning, B.L. Kintz, Computational Handbook of Statistics (4<sup>th</sup> Edition)
2. Helmut Fritz Van Emden, Statistics for Terrified Biologists. Wiley Blackwell (2008)
3. Rebecca W-Bremer, Martina. Statistics at the Bench-A Step-by-Step Handbook for Biologists by Doerge (2009)

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B.Sc. (Hon'rs) Zoology SEMESTER - V

**ELECTIVES I**

**DSE IA: BIOCHEMISTRY AND MOLECULAR BIOLOGY (FUNDAMENTALS OF BIOCHEMISTRY)**

**Unit 1: Carbohydrates:** Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates

**Unit 2: Lipids:** Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

**Unit 3: Proteins:** Amino acids: Structure, Classification and General properties of  $\alpha$ -amino acids; Physiological importance of essential and non-essential  $\alpha$ -amino acids Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants

**Unit 4: Nucleic Acids:** Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA  $H_{19}$ - $H_{19}$  Complementarity of DNA

**Unit 5: Enzymes:** Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of  $K_m$  and  $V_{max}$ , Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action

**Books Recommended**

1. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Boeham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Lusick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

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**DSE IB: ENDOCRINOLOGY (VERTEBRATE ENDOCRINOLOGY)**

- Unit 1:** Vertebrate endocrine system; Hypothalamo-hypophysial system; neurosecretion, hypothalamic neurosecretory centres, neurohypophysis, adenohypophysis, Urohypophysis; Structure and function
- Unit 2:** Pineal organ: structure and function, comparative study of pinealocytes in vertebrates
- Unit 3:** Comparative anatomy of thyroid gland and its role in metamorphosis (amphibian model); Comparative anatomy of adrenocortical and medullary homologues
- Unit 4:** Gonads: Steroidogenic sites, steroid hormones and their function
- Unit 5:** Endocrine control of colour change with emphasis on pars intermedia function in amphibians; Endocrine control of osmoregulation in fish

**DSE IC: FISH BIOLOGY (FISH ANATOMY AND PHYSIOLOGY)**

- Unit 1:** General characters of fishes, Different types of fins, lateral line system, Swim Bladder, sense and electric organ in fishes.
- Unit 2:** Age and growth; Growth rate and age determination, Length weight relationship, hill stream fishes, deep sea fishes and their adaptation
- Unit 3:** Feeding habits, General morphological feature of digestive system, respiration, Accessory respiratory organs in fishes, Heart and blood circulation.
- Unit 4:** Excretion, osmoregulation and reproduction in fish
- Unit 5:** Endocrine and nervous system in fishes

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DSE ID: NEUROSCIENCE (BASICS OF NEUROSCIENCE)

**Unit 1: Introduction**

An introduction to neuroscience, neuroanatomy and neurophysiology.

**Unit 2: The Nervous system**

Introduction to the structure and function of the nervous system: Cellular components: Neurons; Neuroglia; Neuron doctrine; The prototypical neuron – axons and dendrites as unique structural components of neurons. The ionic bases of resting membrane potential; The action potential- its generation and properties: The action potential conduction.

**Unit 3: Cellular and Molecular Neurobiology**

Molecular and cellular approaches used to study the CNS at the level of single molecules, Synapse: Synaptic transmission, Types of synapses; synaptic function; Principles of chemical synaptic transmission; Principles of synaptic integration; EPSPs and IPSPs. Ion channels, Neural transmission.

**Unit 4: Neurotransmitters**

Different types of neurotransmitters- Catecholamines, amino acidergic and peptidergic neurotransmitters; Transmitter gated channels; G-protein coupled receptors and effectors, neurotransmitter receptors; Ionotropic and metabotropic receptors.

**Unit 5: Synapse**

Types of synapses, excitatory and inhibitory post-synaptic potential, chemical transmission.

**Books Recommended**

1. Neuroscience: Exploring the brain by Mark F. Baer; Barry W. Connors. 2015
2. From Molecules to Networks: An Introduction to Cellular and Molecular Neuroscience by John H. Byrne, Ruth Heidelberg and M. Neal Waxham
3. Neuroscience Eds. Dale Purves et. al. (3rd Edn)-Sinauer Associates, Inc. -2004
4. Principles of Neural Science-4th Edn-Eds. Kandel, Schwartz and Jessell- McGrawHill Companies-2000
5. Nerve Cells and Animal Behaviour-2nd Ed-Peter J Simons and David Young-CUP-2003
6. Essential Psychopharmacology- Neuroscientific Basis and Practical Applications- 2nd Edn.-Stephan M. Stahl-CUP-2000
7. Richard F. Thompson: The Brain – A Neuroscience Primer (2<sup>nd</sup> Ed. 1993, W. H. Freeman & Company)
8. The Human Brain Book - Rita Carter-2009

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**DSE IIE: TOXICOLOGY (BASICS OF TOXICOLOGY)**

**Unit 1:** Toxicology: Scope, basic division and goals of toxicology; Type of toxicants; Factors affecting toxicity: species and strain, age, sex, nutritional status, hormones, environmental factors.

**Unit 2:** Dose and response: Dose-response relationship; toxicity curve; toxicity testing; route of exposure; duration of exposure: Acute, Subacute and Chronic; Toxicity tests.

**Unit 3:** Public Health Hazards: Pesticides: Generation of pesticides; Fertilizers; Pesticide and fertilizers residues from agriculture fields & control measures.

**Unit 4:** Emissions: Carbon monoxide, sulphur dioxide, nitric oxide, hydrocarbon, photochemical products; Heavy metals: Source, emission and toxic effect.

**Unit 5:** Radioactive substances: Kinds and source of radiation exposure; biological effect of radiation; Famous accidents of radioactive pollution. Health hazards of food additives.

**Books Recommended**

1. Cassarett and Doull's Toxicology "The Basic Science of The Poisons" 7th edition (2008).
2. Curtis D. Klaassen Editor, McGrawHill Medical. ISBN: 9780071470513.
3. Cassarett and Doull's "Essentials of Toxicology" 2nd edition (2010), Klaassen and Whatkins, McGraw Hill Publisher. ISBN-13: 978-0071622400.
4. Introduction to Toxicology, 3rd edition (2001), John Timbrell, Taylor and Francis Publishers. ISBN 13: 9780415247627.
5. Principles of Toxicology, 2nd edition (2006), Stine Karen and Thomas M Brown, CRC press. ISBN-13: 978-0849328565.
6. Lu's basic toxicology: Fundamentals target organ and risk assessment, 5th edition (2009).
7. Frank C Lu and Sam Kacow, Informa Health care. ISBN: 9781420093117.

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Department of Zoology, GGV, Bilaspur (CG)

B.Sc. (Hon's) Zoology SEMESTER V

ZOO- CC503: Practical (Credits- 02)

Lab course based on 504 and elective paper

**BIostatISTICS**

1. Mean
2. Median
3. Mode
4. Mean deviation
5. Standard deviation

**BIOCHEMISTRY**

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.

**ENDOCRINOLOGY**

1. Handling, sexing, numbering and maintenance of rat
2. General survey of endocrine glands in rat through chart
3. Study of vaginal smear preparation of rat
4. Study of histological slides of the following endocrine glands: pituitary, thyroid, adrenal, endocrine pancreas, testis and ovary
5. Thyroid of fish (pharyngeal and ectopic) and reptile
6. Adrenal homologues (interrenal and chromaffin tissues) in fish and reptile
7. Cell types of fish pituitary
8. Demonstration of frog metamorphosis

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**FISH BIOLOGY**

1. Study of scales- Placoid, Cycloid and Ctenoid
2. Study of accessory respiratory organs in Anabas, Clarias and Heteropneustes
3. Determination of feeding habit of important edible fishes
4. Study of ventilation rate an air-breathing fish under different experimental conditions.
5. Determination and comparison of hemoglobin content of water-breathing and air breathing fish
6. Determination of gonadosomatic index
7. Survey of different endocrine glands of fishes.
8. Study of Histological slides of fishes

**NEUROSCIENCE**

1. Dissection and study of Drosophila nervous system.
2. Study of neurons and/ or myelin by Nissl, Giemsa or Luxol Fast Blue staining.
3. Study of olfaction in Drosophila.
4. Study of novelty, anxiety and spatial learning in mice.
5. Study of pituitary and pineal cell types through prepared slides.
6. Some important behavioural techniques in neuroscience:
  - (a). Morris water maze
  - (b). 8 Arm radial maze or T - Maze
  - (c). Rotarod for studying behaviour in rats.

**TOXICOLOGY**

1. Handling of laboratory animals.
2. Routes of drug administration (Oral, I.M., I.P, S.C.)
3. Collection of blood samples from rats/mice
4. Estimation of non enzymatic antioxidants: glutathione.
5. Measurement of liver function tests for toxicity study.
6. Measurement of kidney function test for toxicity study.
7. Demonstration of toxic effects of various xenobiotics using computer simulation programs/virtual labs.

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Department of Zoology, GGV, Bilaspur (CG)

B.Sc. (Hon's) Zoology SEMESTER - VI  
ZOO-CC: 601

**MICROBIOLOGY AND PARASITOLOGY**

**Unit 1: Microbiology**

(05 hrs)

Introduction to microbes: Viruses, Bacteria and Eukaryotic microorganisms; classification of bacteria based on shape and size, nutrition and staining methods, beneficial and harmful interactions of microbes with human.

**Unit 2: Viruses**

(04 hrs)

General structure, properties, classification and replication, lytic cycle, lysogeny. Virions, Prions, Virulence factor and toxins.

**Unit 3: Techniques in microbiology**

(05 hrs)

Media preparation, culture and growth of microorganisms, Applied microbiology: production of antibiotics, biopesticides, biopolymers; Dairy Microbiology; fermentation and fermentable microbes.

**Unit 4:**

(5 hrs)

Protozoa and Diseases: Life cycle of Protozoans parasites: *Entamoeba histolytica*, *Leishmania donovani*, *Trypanosoma gambiense*, *Plasmodium*- pathogenesis, treatment and prevention.

**Unit 5:**

(5 hrs)

Life cycle of Parasitic Helminths: *Echinococcus granulosus*, *Schistosoma haematobium* and *Wuchereria bancrofti*, *Ancylostoma*- pathogenesis, treatment and prevention.

**Books Recommended**

1. Madigan, Martinko and Parker: Brock Biology of Microorganisms (12<sup>th</sup> ed. 2009, Pearson/Benjamin Cummings)
2. Stanier, Ingraham, Wheelis and Painter: General Microbiology (5<sup>th</sup> ed. 2005, Mc Millan)
3. Tortora, Funke and Case: Microbiology: An introduction (2008)
4. Willey, Sherwood and Woolverton: Prescott, Harley and Klein's Microbiology (7<sup>th</sup> ed. 2008, McGraw Hill Higher Education)

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B.Sc. (Hon's) Zoology SEMESTER - VI

ZOO-CC: 604

**DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY**

**Unit 1: Development of Zygote**

(05 hrs)

Types of eggs and pattern of cleavage; Gastrulation and fate map; Comparison of cleavage and gastrulation in sea urchin, frog and chick embryos.

**Unit 2: Axis formation**

(05 hrs)

Determination and differentiation: Morphogenetic gradients in sea urchin egg; Organizer concept; Mechanism of axis determination in amphibians and functions of the organizers; Induction and determination during vertebrate eye formation.

**Unit 3: Metamorphosis and Cellular Potency**

(04 hrs)

Mechanism of metamorphosis in frog; extra-embryonic membranes in mammals; Parthenogenesis; Regeneration; types and functions of placenta in mammals; Concept of Potency and application of embryonic stem cells.

**Unit 4: Introduction to immunity**

(05 hrs)

Introduction to immunity; Innate and acquired immunity; Cells and organs of immune system; Types of immune cells, Primary and secondary lymphoid organs and lymphatic system.

**Unit 5: Acquired immunity**

(05 hrs)

Humoral immunity: Antigen, Immunoglobulins (types, diversity), antigen antibody interaction, Cell mediated immunity: Structural organization of MHC complex, Antigen processing and presentation, Functions of T-cells.

**Books Recommended**

**Developmental Biology**

1. Gilbert: Developmental Biology (9<sup>th</sup> ed. 2010, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA)
2. Kalthoff: Analysis of Biological Development (2<sup>nd</sup> ed. 2008, McGraw-Hill Publishers)
3. Wolpert: Principles of Development (3<sup>rd</sup> ed. 2007, Oxford)

**Immunology**

1. Acharya et al: Immunology (2<sup>nd</sup> ed. 2011, Kalyani Publishers, Ludhiana Punjab)
2. Abbas et al: Cellular and Molecular Immunology (6<sup>th</sup> ed. 2007, Saunders)
3. Janeway's Immunobiology (7<sup>th</sup> ed. 2008, Garland Science Publication)
4. Kubey et al: Immunology (6<sup>th</sup> ed. 2007, W.H. Freeman and Company Publication, New York)
5. Roitt and Delvis: Roitt's Essential Immunology (6<sup>th</sup> ed. 2006, Blackwell Publication)

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Department of Zoology, GGV, Bilaspur (CG)

B.Sc. (Hons) Zoology SEMESTER VI

ZOO-CC: 603

Practical (Credits- 03): Lab course based on 601 and 602

**MICROBIOLOGY**

Identification of gram positive and gram negative bacteria through temporary slides.

1. Study of bacterial growth curve.
2. Study of microflora of milk.
3. Study of leguminous bacteria.
4. Study of different lymphoid organ of rat.
5. Differential counting of blood immune cells.
6. Cell imprinting of thymus and spleen.
7. Identification of Blood Group

**PARASITOLOGY**

7. Identification protozoan parasites from permanent slides.
8. Identification and characterization of helminth parasites from permanent slides
9. Study of permanent slides of different larvae of insects and helminthes.
10. Study of specimens and models relevant to theory paper.
11. Study of life cycle of insects through chart/specimens

**BIOTECHNIQUES**

1. Principle and working of Centrifuges.
2. Principle and working of Chromatography (Paper chromatography)
3. Principle and working of colorimeter and spectrophotometer
4. Cell counting using haemocytometer (by using suitable stain)
5. Working and principle of flow cytometry
6. Measuring of pH using a pH meter
7. Gel electrophoresis: Nucleic acid and Protein electrophoresis.

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B. Sc. (Hons) Zoology Semester VI  
ZOO-CC-602

**BIOTECHNIQUES**

**Unit 1:**

(05 hrs)

Quantification techniques: Measuring of pH using paper strips, pH meter; Centrifugation (sedimentation, density gradient)

**Unit 2:**

(05 hrs)

Principle of colorimeter and spectrophotometer; Cell counting by using haemocytometer cells sorting by flow cytometer.

**Unit 3:**

(05 hrs)

Basic principles of microscopy: Type of microscopes: Bright field, dark-field, Phase Contrast, fluorescence, electron and confocal; Microscopic measurements: micrometry using the ocular and stage micrometer. Tissue fixation, block preparation and sectioning / microtomy.

**Unit 4:**

(05 hrs)

Cell and tissue culture technique; Laminar flow; Culture media; Sterilization: room, culture media and glass wares, types of animal cell culture. Cell viability, Cryopreservation.

**Unit 5:**

(05 hrs)

Electrophoresis: Nucleic acid and Protein electrophoresis; Chromatography: Principle and applications of i) Thin layer, ii) Gel filtration, iii) Ion change iv) HPLC and v) Gas Chromatography.

**Books Recommended**

1. Wilson and Walker: Experimental Biochemistry (2006, Cambridge)
2. Boyer: Modern Experimental Biochemistry (1993, Benjamin - Cummings)
3. Pearse: Histochemistry - Theoretical and applied, Volume I-III (1980-1993, Churchill-Livingstones)
4. Plummer: An introduction to Practical Biochemistry (1989, McGraw Hill)

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