



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

Department : Zoology

Programme Name : B. Sc

Academic Year : 2020-21

List of Courses Focus on Employability/ Entrepreneurship/Skill

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 P	Food Nutrition and Health
20.	LS/ZOO/GE-302 L	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
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.	LS/ZOO/CC-501 L	Molecular Biology
34.	LS/ZOO/CC-501 P	Lab Course
35.	LS/ZOO/CC-502 L	Principles of Genetics
36.	LS/ZOO/CC-502 P	Lab Course
37.	LS/ZOO/DSE-502 (C) L	Reproductive Biology
38.	LS/ZOO/DSE-502 (C) P	Lab Course
39.	LS/ZOO/CC-601 L	Developmental Biology
40.	LS/ZOO/CC-601 P	Lab Course
41.	LS/ZOO/CC-602 L	Evolutionary Biology
42.	LS/ZOO/CC-602 P	Lab Course
43.	LS/ZOO/DSE-601 (A) L	Biology of Insecta
44.	LS/ZOO/DSE-601 (A) P	Lab Course
45.	LS/ZOO/DSE-601 (B) L	Fish and Fisheries
46.	LS/ZOO/DSE-601 (B) P	Lab Course

A. V. K. Bhaskar

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Scheme and Syllabus

Semester-wise Theory Papers/ Practical: B.Sc. Hon's (Zoology) Department of Zoology, School of Life Science

SEMESTER I						
Course Opted	Course Code	Name of the course	Credit	Hours /week	Internal Assessment	End Semester Exam.
Core Course-1 Theory	LS/ZOO/CC-101 L	Non Chordates - I (Protozoa to Pseudocoelomate)	4	4	30 (15+15)	70
Core Course-1 Practical	LS/ZOO/CC-101 P	Lab Course	2	4	30 (15+15)	70
Core Course-2 Theory	LS/ZOO/CC-102 L	Principles of Biology	4	4	30 (15+15)	70
Core Course-2 Practical	LS/ZOO/CC-102 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-1 Theory	LS/ZOO/GE-101 L	Aquatic Biology	4	4	30 (15+15)	70
Generic Elective-1 Practical	LS/ZOO/GE-101 P	Lab Course	2	4	30 (15+15)	70
Ability Enhancement Compulsory Course-1	LS/ZOO/AE-101/EC	English Communication / Hindi Communication	4*	4	30 (15+15)	70
Extracurricular Activity		Tour/ Field visit/ Industrial training/ NSS/ Swachhta/ Vocational Training/ Sports/ others	2	(2)		
TOTAL			24	28	30	70
SEMESTER II						
Core Course-3 Theory	LS/ZOO/CC-201 L	Non Chordates - II (Coelomates)	4	4	30 (15+15)	70
Core Course-3 Practical	LS/ZOO/CC-201 P	Lab Course	2	4	30 (15+15)	70
Core Course-4 Theory	LS/ZOO/CC-202 L	Cell Biology	4	4	30 (15+15)	70
Core Course-4 Practical	LS/ZOO/CC-202 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-2 Theory	LS/ZOO/GE-201 L	Environment and Public Health	4	4	30 (15+15)	70
Generic Elective-2 Practical	LS/ZOO/GE-201 P	Lab Course	2	4	30 (15+15)	70
Ability Enhancement Compulsory Course-2	LS/ZOO/AE-201/ES	Environmental Science	4*	4	30 (15+15)	70
Extracurricular Activity		Tour/ Field visit/ Industrial training/ NSS/ Swachhta/ Vocational Training/ Sports/ others	2	(2)		
TOTAL			24	28	30	70
Summer Internship: 15 days		Swachta Swachhta / NSS / Industrial/ others	2	6h/day	-	100
SEMESTER III						
Core Course-5 Theory	LS/ZOO/CC-301 L	Diversity of chordates	4	4	30 (15+15)	70
Core Course-5 Practical	LS/ZOO/CC-301 P	Lab Course	2	4	30 (15+15)	70
Core Course-6 Theory	LS/ZOO/CC-302 L	Physiology: Controlling and Coordinating Systems	4	4	30 (15+15)	70
Core Course-6 Practical	LS/ZOO/CC-302 P	Lab Course	2	4	30 (15+15)	70
Core Course-7 Theory	LS/ZOO/CC-303 L	Fundamentals of Bio-chemistry	4	4	30 (15+15)	70

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Core Course-7 Practical	LS/ZOO/CC-303 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-3 Theory	LS/ZOO/GE-301 L	Food Nutrition and Health	4	4	30 (15+15)	70
Generic Elective-3 Practical	LS/ZOO/GE-301 P	Lab Course	2	4	30 (15+15)	70
Skill Enhancement Course-1	LS/ZOO/SEC-301 L	Serials	2	2	30 (15+15)	70
Skill Enhancement Course-1	LS/ZOO/SEC-301 P	Lab Course	2	4	30 (15+15)	70
TOTAL			28	34	30	70
SEMESTER IV						
Core Course-8 Theory	LS/ZOO/CC-401 L	Comparative anatomy of vertebrates	4	4	30 (15+15)	70
Core Course-8 Practical	LS/ZOO/CC-401 P	Lab Course	2	4	30 (15+15)	70
Core Course-9 Theory	LS/ZOO/CC-402 L	Physiology: Lids Sustaining System	4	4	30 (15+15)	70
Core Course-9 Practical	LS/ZOO/CC-402 P	Lab Course	2	4	30 (15+15)	70
Core Course-10 Theory	LS/ZOO/CC-403 L	Biochemistry of Metabolic Processes	4	4	30 (15+15)	70
Core Course-10 Practical	LS/ZOO/CC-403 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-4 Theory	LS/ZOO/GE-401 L	Insect Vectors and Diseases	4	4	30 (15+15)	70
Generic Elective-4 Practical	LS/ZOO/GE-401 P	Lab Course	2	4	30 (15+15)	70
Skill Enhancement Course-2	LS/ZOO/SE-401	Medical Diagnostics	2	2	30 (15+15)	70
Skill Enhancement Course-2	LS/ZOO/SE-401	Lab Course	2	4	30 (15+15)	70
TOTAL			28	34	30	70
Summer Internship: 15 days	Swayam Swachhita / NSS / Industrial/ others		2	60/day	—	100
SEMESTER V						
Core Course-11 Theory	LS/ZOO/CC-501 L	Molecular Biology	4	4	30 (15+15)	70
Core Course-11 Practical	LS/ZOO/CC-501 P	Lab Course	2	4	30 (15+15)	70
Core Course-12 Theory	LS/ZOO/CC-502 L	Principles of Genetics	4	4	30 (15+15)	70
Core Course-12 Practical	LS/ZOO/CC-502 P	Lab Course	2	4	30 (15+15)	70
Discipline Specific Elective-1 Theory	LS/ZOO/DSE-501(A) L	*A. Biology of Insect (MOOCs)	4	4	30 (15+15)	70
	LS/ZOO/DSE-501(B) L	*B. Immunology (MOOCs)				
Discipline Specific Elective-1 Practical	LS/ZOO/DSE-501(A) P	Lab Course A	2	4	30 (15+15)	70
	LS/ZOO/DSE-501(B) P	Lab Course B				
Discipline Specific Elective-2 Theory	LS/ZOO/DSE-502(A) L	A. Basics of Neuroscience	4	4	30 (15+15)	70
	LS/ZOO/DSE-502(B) L	B. Reproductive Biology				
Discipline Specific Elective-2 Practical	LS/ZOO/DSE-502(A) P	Lab Course A	2	4	30 (15+15)	70
	LS/ZOO/DSE-502(B) P	Lab Course B				
TOTAL			14	32		

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Semester V				
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 Chemobiology 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
TOTAL			24	32
Semester VI				
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
TOTAL			24	32
TOTAL CREDITS			152 + 4 (SI)	

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 IIIrd and IVth semester, so that all the student can have exposure of one additional subject.
(Subject to approval by the competent authority)

Chandee External Expert
Dr. Kollit Seth 06/07/18
Santosh Singh Dr. Santosh Singh
Moulik Head of the Department

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

CORE COURSE I

LS/ZOO/CC-101 I

NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATA

THEORY

(Credits 4)

Unit 1: Protista, Parazoa and Metazoa	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; Types of symmetry.	
Unit 2: Porifera	7
General characteristics and classification up to classes; Type study of <i>Sycon</i> ; Canal system and spicules in sponges.	
Unit 3: Cnidaria	12
General characteristics and classification up to classes; Type study of <i>Obelia</i> ; Polymorphism in Cnidaria; Corals and coral reefs.	
Unit 4: Ctenophora	4
General characteristics and Evolutionary significance.	
Unit 5: Platyhelminthes	10
General characteristics and classification up to classes; Type study, larval forms and pathogenicity of <i>Fasciola hepatica</i> .	
Unit 6: Nematelminthes	8
General characteristics and classification up to classes; Type study of <i>Aricaris lumbricoides</i> ; Life cycle and pathogenicity of <i>Wuchereria bancrofti</i> ; Parasitic adaptations in helminthes.	

Course Objectives:

Core course Protista to Pseudocoelomate will help to understand the behavior, structure and evolution of animals. To make the graduate students aware with the importance of Plant-like protista and organisms belong to invertebrate animal whose body cavity is a pseudocoel rather than a true coelom.

Course Outcomes:

These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research. Therefore, this study will help in identify the two groups of pseudocoelomates, their general characteristics and the human impacts of nematodes.



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

CORE COURSE I

LS/ZOO/CC-101 P

NON-CHORDATES I: PROTISTA TO PSEUDOCORLOMATA

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 Sycos (T.S. and L.S.), *Hydrozoa*, *Euplocyella*, *Spongilla*
4. Study of *Obelia*, *Physalia*, *Milipora*, *Aurelia*, *Tubipora*, *Corallium*, *Alysiatum*, *Gorgonia*, *Metridium*, *Pennatul*, *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/microphotographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

SUGGESTED READINGS

- Ruppert and Barnes (2006). Invertebrate Zoology, VIII Edition, Holt Saunders International Edition.
- Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JJ (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
- Barrington EJW (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)

Unit 1: Introduction to Ecology

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-Temperature and Light.

Unit 2: Ecosystem

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.

Unit 3: Population

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.

Unit 4: Community

10

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological Succession, Types of Succession, Theories pertaining to climax community.

Unit 5: Human Impact on environment

06

Environmental Pollution: Air, water and noise pollution; Greenhouse effect, Acid rain, Global Warming, Ozone depletion.

Unit 6: Biodiversity and Wildlife Conservation

08

Ecology in Wildlife Conservation and Management, Biodiversity: types, importance and threats. Protected areas; National parks, Bio reserves and Sanctuaries, Restoration ecology.

Course Objectives:

To bring physical environment and living organisms together in a single framework.
To develop an appreciation of the modern scope of the scientific study in the field of ecology. To understand different types of ecosystem, extinction of species consumption, human impact on the environment.

Course Outcomes:

Develop knowledge base covering all attributes of the environment and ecology.
Illustrate the flow of energy through ecosystems with reference to trophic levels and ecological efficiency. Describe population structures and growth.

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CORE COURSE II

LS/ZOO/CC-102 P PRINCIPLES OF ECOLOGY

PRACTICALS

(Credits 2)

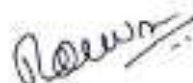
1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided.
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
3. Study of an 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 CO₂.
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary.

SUGGESTED READINGS

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


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CORE COURSE III

LS/ZOO/CC-201 L

NON-CHORDATES II: COELOMATA

THEORY

(Credits 4)

Unit 1: Introduction to Coelomates Evolution of coelom and metamerism.	2
Unit 2: Annelida General characteristics and Classification up to classes; Type study of <i>Pheretima</i> ; Metamerism in Annelids.	10
Unit 3: Arthropoda 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.	17
Unit 4: Onychophora General characteristics and Evolutionary significance with special reference to <i>Peripatus</i> .	4
Unit 5: Mollusca 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.	15
Unit 6: Echinodermata 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.	12

Course Objectives:

To discuss representative lineages of the protostome coelomates, including molluscs, annelids and arthropods. Students will know how are these groups of animals similar? What morphological and developmental patterns do they have in common? How do they differ?

They will know the importance of segmentation in the annelids. Students will come to know why the animals in Phylum Arthropods are thought to be so successful.

Course Outcomes:

Compare the two groups (Acoelomate and Coelomates) of animals with true coeloma, the protostomes and deuterostomes, including the differences in development seen in these two groups.

Explain the characteristics of arthropods that have made them successful.

Review the diversity of arthropod groups, including trends in arthropod evolution.



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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, Palaemonetes, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scalopendra, Julus, Bombyx, Periplaneta*. termites and honey bees etc.
Onychophora - *Peripatus*
Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus* etc.
Echinoderms - *Pentaceros/Arterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon* etc.
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T. S. through pharynx, gizzard, and typhlocoecal 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 (2006). *Invertebrate Zoology*, VIII Edition, Holt Saunders International Edition.
- Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JJ (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.
- Barrington EJW (1979). *Invertebrate Structure and Functions*, II Edition, E.L.B.S. and Nelson.
- Nigam (1997). *Biology of Chordates*, S. Chand.
- Kotpal, *Modern text book of Zoology: Vertebrates*, Rastogi Publication.



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

CORE COURSE IV

LS/ZOO/CC-202 L

CELL BIOLOGY

THEORY

(Credits 4)

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

Course Objective:

Course is designed to provide fundamental understanding of structure and functions of prokaryotic and eukaryotic cells, especially plasma membrane, cell organelles, cytoskeleton and nucleus. Student will understand how these organelles work together to produce and utilize the energy for maintaining the cell functions. How cellular components are performing the cell division, inheritance and cell signaling.

Course Outcomes:

Students will apply the knowledge of cell biology to understand the mechanism of individual metabolism and physiology, and also changes occur during the environmental interaction.



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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 *Chironomus* larva.
7. Preparation of permanent slide to show the presence of Barr body in human female blood cells/check cells.

SUGGESTED READINGS

- Karp (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition, John Wiley and Sons Inc.
- De Robertis EDP and De Robertis EMF (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper GM and Hausman RE (2009). The Cell: A Molecular Approach. V Edition; ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker WM, KleinSmith LJ, Hardin J and Bertoni GP (2009). The World of the Cell, VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Albert B, Dennis B, Julian L, Martin R, Keith R and James W (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
- Lodish et al (2008). Molecular Cell Biology, Freeman.

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

GENERIC ELECTIVE COURSES

LS/ZOO/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, Seveso disaster and Three Mile Island accident and their aftermath.

Unit 5: Diseases

Causes, symptoms and control of tuberculosis, Asifms, Cholera, Minamata disease, typhoid

Course Objective:

To understand the direct and indirect human, ecological and safety effects of major environmental and occupational agents.

Attain knowledge about genetic, physiologic and psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental hazards.

Specify approaches for assessing, preventing and controlling environmental hazards that pose risks to human health and safety.

To understand various waste management techniques and risks involved in event of poor management.

Understand the outbreak of certain communicable and non-communicable diseases.

Course Outcomes:

Acquire skills in the application of epidemiologic methods to environmental health problems



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

GENERIC ELECTIVE COURSES

LS/ZOO/GE-201 P

ENVIRONMENT AND PUBLIC HEALTH

PRACTICALS

(Credits 2)

1. To determine Pb in soil and water samples from different locations.
2. To determine Cl in soil and water samples from different Locations
3. To determine SO₄ in soil and water samples from different Locations
4. To determine NO₃ in soil and water samples from different Locations
5. To determine BOD in water samples from different locations

SUGGESTED BOOKS

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

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

CORE COURSE V

LS/ZOO/CC-301 P

DIVERSITY OF CHORDATA

PRACTICALS

(Credits 2)

1. Protochordata

Balanoglossus, Herdmania, Branchiostoma, Colonial Vertebrates, Sections of *Balanoglossus* through proboscis and branchiostomal 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, Labeo, Catla, Cirrhinus, Exocoetus, Echinatis, 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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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

CORE COURSE VI

LS/ZOO/CC-302 L

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

THEORY

(Credits 4)

Unit 1: Tissues	6
Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue	
Unit 2: Bone and Cartilage	4
Structure and types of bones and cartilages, Ossification, bone growth and resorption	
Unit 3: Muscle	12
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	
Unit 4: Nervous System	10
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.	
Unit 5: Endocrine System	18
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	
Unit 6: Reproductive System	10
Histology of testis and ovary, Physiology of male and female reproduction; Puberty, Methods of contraception in male and female	

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

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

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 α -amino acids; Physiological importance of essential and non-essential α -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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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

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

GENERIC ELECTIVE COURSES

LS/ZOOGF-301 L

FOOD, NUTRITION AND HEALTH

THEORY

(Credits 4)

Unit 1: Basic concept of food and nutrition	5
Food Components and food-nutrients Concept of a balanced diet, nutrient needs and dietary pattern for various groups	
Unit 2: Nutritional Biochemistry:	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	
Unit 3: Health-I	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	
Unit 4: Health-II	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	
Unit 5: Food Hygiene-I	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,	
Unit 6: Food Hygiene-II	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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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
2. Estimation of Lactose in milk
3. Ascorbic acid estimation in food by titrimetry
4. Estimation of Calcium in foods by titrimetry
5. 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.
6. 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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Department of Zoology, School of Life Sciences, GGV, Bilaspur (CG)

SKILL ENHANCEMENT COURSES

LS/ZOO/SEC-301 L

SERICULTURE

THEORY

(Credits 4)

Unit 1: Introduction	5
Sericulture: Definition, history and present status; Types of silkworms: Exotic and indigenous species. Mulberry and non-mulberry sericulture.	
Unit 2: Biology of Silkworm	10
Life cycle of <i>Bombix mori</i> ; Structure of silk gland and secretion of silk.	
Unit 3: Rearing of Silkworms	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.	
Unit 4: Silkworm Genetics and Breeding	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.	
Unit 5: Pests and Diseases	10
Pests of silkworm: Uzi fly, dermestid beetles and vertebrates. Protozoan, viral, fungal and bacterial diseases. Control and prevention of pests and diseases.	
Unit 6: Entrepreneurship in Sericulture	10
Prospects of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.	

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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 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, Pd. 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)

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

LS/ZOO/CC-402 L

ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

THEORY

(Credits 4)

Unit 1: Integumentary system	6
Cell junction, epithelial and connective tissue, structure, type and function of skin, accessory structure of skin	
Unit 2: Digestion	14
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.	
Unit 3: Respiration	10
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	
Unit 4: Renal Physiology	12
Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance	
Unit 5: Blood	8
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	
Unit 6: Physiology of Heart	10
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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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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CORE COURSE X

LS/ZOO/CC-403 L

BIOCHEMISTRY OF METABOLIC PROCESSES

THEORY

(Credits 4)

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

Unit I: Introduction to Insects	6
General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits.	
Unit II: Insect Vectors	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.	
Unit III: Diptera as Disease Vectors	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.	
Unit IV: Siphonaptera as Disease Vectors	6
Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas.	
Unit V: Siphunculata as Disease Vectors	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.	
Unit VI: Hemiptera as Disease Vectors	6
Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures.	

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Sanjay Singh



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

Ramesh

Sanku Singh

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Moulik

Dangal

विभागाध्यक्ष
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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)

Unit 1: Introduction to Medical Diagnostics and its Importance	2
Unit 2: Diagnostics Methods Used for Analysis of Blood 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
Unit 3: Diagnostic Methods Used for Urine Analysis Urine Analysis: Physical characteristics; Abnormal constituents	6
Unit 4: Non-infectious Diseases 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
Unit 5: Infectious Diseases Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis	3
Unit 6: Tumours 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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Bilaspur

Santosh Singh

Arjun



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

CORE COURSE XI

LS/ZOO/CC-501 L

MOLECULAR BIOLOGY

THEORY

(Credits 4)

Unit 1: Nucleic Acids

Salient features of DNA and RNA Watson and Crick model of DNA; Ribo-switches, Different types of RNAs

8

Unit 2: DNA Replication

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres, Concept of DNA repairing

12

Unit 3: Transcription

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

10

Unit 4: Translation

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference in prokaryotic and eukaryotic translation

12

Unit 5: Post Transcriptional Modifications and Processing of RNA

Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, Processing of tRNA

8

Unit 6: Gene Regulation

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp* operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting; RNA interference.

10

Course Objective:

Course is designed to understand the life process at sub-cellular and molecular level. Define the molecular mechanisms by which DNA controls development, growth or morphological characteristics of cell and organisms.

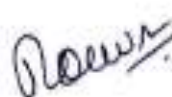
Course Outcomes:

Students will be able to understand the molecular mechanism of living system that enables them to designed knowledge in applied science.


S.K. Sharma

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S.K. Sharma


S.K. Sharma



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

CORE COURSE XI

LS/ZOO/CC-501 P

MOLECULAR BIOLOGY

PRACTICALS

(Credits 2)

1. Study the structure of nucleotides, DNA and RNA through model/ charts.
2. Study of Polytene chromosomes from Chironomous / Drosophila larvae
3. Preparation of agar culture plate and raise culture of bacteria (*E. coli*)
4. Preparation of liquid culture medium
5. Demonstration of DNA extraction process
6. Demonstration of RNA extraction process
7. Study and interpretation of electron micrographs/ photograph showing
(a) DNA replication
(b) Transcription
(c) Split genes

SUGGESTED READINGS

- 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 Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.
- Cooper G. M. and Robert E. Hausman R. E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*, VI Edition. John Wiley and Sons, Inc.
- Lewin B. (2008). *Gene XI*, Jones and Bartlett.
- McLennan A., Bates A., Turner, P. and White M. (2015). *Molecular Biology*, IV Edition. GS, Taylor and Francis Group, New York and London.



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

CORE COURSE XII

LS/ZOO/CC-502 L

PRINCIPLES OF GENETICS

THEORY

(Credits 4)

Unit 1: Mendelian Genetics and its Extension

8

Principles of inheritance (Mendel's Laws), Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance, concept of gene.

Unit 2: Linkage, Crossing Over and Chromosomal Mapping

16

Linkage and crossing over, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence; Introduction to conjugation, transformation and transduction

Unit 3: Mutations

12

Types of gene mutations (Classification) and causes, Chromosomal aberrations, Molecular basis of mutations in relation to UV light and chemical mutagens;

Unit 4: Sex Determination and Extra-chromosomal Inheritance

12

Chromosomal mechanisms of sex determination in *Drosophila* and Man, Extra-chromosomal inheritance with suitable example, Mitochondrial DNA

Unit 5: Polygenic Inheritance

4

Polygenic inheritance; with suitable examples; numericals based on it.

Unit 6: Transposable Genetic Elements

8

Transposition; Transposons in bacteria, P elements in *Drosophila*, Transposons in humans, Transposons as mutagens.

Course Objective:

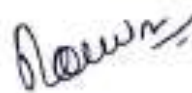
- To study the structure and function of gene.
- To study how gene is hereditary material.
- To study how is gene contribute to an organism's wellbeing.

Course Outcomes:

- Develop in-depth knowledge of gene function and development.
- Students will develop understanding about how gene inherits from generation to generation.
- Students will develop understanding about how gene related disease can alter the life of an organism.


Shreyas


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

CORE COURSE XII

LS/ZOO/CC-502 P

PRINCIPLES OF GENETICS

PRACTICALS

(Credits 2)

1. To study the Mendelian laws with suitable examples.
2. Chi-square analyses using seeds/beads/*Drosophila*.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. *Drosophila* biology: Sexual dimorphism, Life cycle and different mutant's types.
5. Linkage maps based on data from *Drosophila* crosses.
6. Study of human karyotype (normal and abnormal).
7. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings
- Russell, P. J. (2009). *Genetics- A Molecular Approach* III Edition. Benjamin Cummings
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co
- Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York and London.

Bhates



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

DISCIPLINE SPECIFIC ELECTIVE COURSE

LS/ZOO/DSE-502(B) I

REPRODUCTIVE BIOLOGY

THEORY

(Credits 4)

Unit 1: Functional anatomy of male reproduction

12

Outline and histology of male reproductive system in human; Testis: Cellular functions, germ cell; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract.

Unit 2: Functional anatomy of female reproduction

12

Reproductive cycles (rat and human) and their regulation, changes in the female tract; Outline and histological of female reproductive system in human; Ovary: folliculogenesis ovulation, corpus luteum formation and regression; secretion of ovarian hormones.

Unit 3: Gametogenesis

12

Spermatogenesis: kinetics and hormonal regulation, Androgen synthesis and metabolism; Oogenesis, Hormonal regulation of Oogenesis, Steroidogenesis Pathway and regulation, STAR, SRBPE.

Unit 4:12

Hormonal regulation of gestation, pregnancy diagnosis, foeto-maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation.

Unit 5: Reproductive Endocrinology

12

Mechanism of action of Gonadal hormone, steroids, glycoprotein hormones, prostaglandins, hypothalamo - hypophyseal - gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit 6: Reproductive Health

12

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning.

Course Objective:

Aims to understand the scientific principles that govern reproduction in humans and other mammals.

Course Outcomes:

Advances in this field provided the knowledge for assisted conception and revolutionized reproductive medicine and veterinary practice.

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

DISCIPLINE SPECIFIC ELECTIVE COURSE

LS/ZOO/DSE-502(B) P

REPRODUCTIVE BIOLOGY

PRACTICALS

(Credits 2)

1. Study of animal house: set up and maintenance of animal house, brooding techniques, care of normal and experimental animals.
2. Examination of vaginal smear ~~rats~~ from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovariectomy, hysterectomy, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat.
7. Study of modern contraceptive devices.
8. Mini projects involving survey, data collection, statistical analysis, and submission of a project report on reproductive health of a small human population.

SUGGESTED READINGS

- Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

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

CORE COURSE XIII

LS/ZOO/CC-601 L

DEVELOPMENTAL BIOLOGY

THEORY

(Credits 4)

Unit 1: Introduction	12
Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation (Axis formation in <i>Drosophila</i>), Differential gene expression, Cytoplasmic determinants and asymmetric cell division; Basic concept of induction, competence, specification and differentiation.	
Unit 2: Gamete Biology and Fertilization	10
Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal); Sperm egg interaction; Changes in gametes, Blocks to polyspermy	
Unit 3: Early Embryonic Development	10
Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers	
Unit 4: Late Embryonic Development	8
Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)	
Unit 5: Post Embryonic Development	12
Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphic regeneration of Salamander limbs, morphallactic regeneration in <i>Hydra</i> and compensatory regeneration in mammalian liver; Ageing: concept and theories.	
Unit 6: Implications of Developmental Biology	8
Teratogenesis: Teratogenic agents and their effects on embryonic development; <i>In vitro</i> fertilization, Stem cell (ESC), Amniocentesis	

Course objective

The main aim of the paper on Developmental Biology is to provide an in-depth knowledge on the embryonic and post embryonic developmental processes. The course explains the basic principles and concepts underlying the developmental processes at the cellular and molecular level. By understanding the developmental processes the students can relate to errors occurring in during development leading to congenital disorder and human diseases. The paper also addresses the problem of infertility in humans and how to overcome this

Course Outcomes

Students will be able to understand the fundamentals of developing process. Knowledge regarding embryonic and post embryonic developments will be imparted to students.

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

CORE COURSE XIII

LS/ZOO/CC-601 P

DEVELOPMENTAL BIOLOGY

PRACTICALS

(Credits 2)

1. Collection, preparation and Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Window preparation to study chick embryo development
4. Study of the developmental stages and life cycle of *Drosophila* from stock culture
5. Study of different sections of placenta (photomicrograph/ slides)
6. Project report on *Drosophila* culture/chick embryo development
7. A visit to Poultry farm/TVF centre

SUGGESTED READINGS

- Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Carlson, R. F. Patten's Foundations of Embryology
- Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw- Hill Publishers
- Lewis Wolpert (2002). Principles of Development, II Edition, Oxford University Press



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CORE COURSE XIV

LS/ZOO/CC-602 L

EVOLUTIONARY BIOLOGY

THEORY

(Credits 4)

Unit 1: Origin of Life Chemogeny and Biogeny, RNA world.	4
Unit 2: Historical Review of Evolutionary Concept Lamarckism, Darwinism, Neo-Darwinism.	10
Unit 3: Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesizing machinery, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c, role of heritable variations in evolution.	16
Unit 4: Population Genetics: Hardy-Weinberg Law; Natural selection (concept of fitness, selection coefficient, types of selection, genetic drift (mechanism, founder's effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies.	12
Unit 5: Product of Evolution Micro evolutionary changes (inter-population variations, clines, races, species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees.	8
Unit 6: Species Concepts and Species Attribute The "Modern Synthesis". The nature of evolutionary units; Species concepts, The Biological Species concept.	10

Course Objective:

The course aims to provide students with a deeper insight into the evolutionary processes - both selective and random which can explain the genetic composition of populations, form, behavior and distribution of organisms, and to teach students the basic methods of analyzing the evolutionary relationships between species.

Course Outcome:

A student who has completed the course should have solid knowledge of: natural selection as key to understanding the natural world; how natural selection produces adaptation; the origins of genetic variation; population genetic consequences of selection, mutation, migration (gene flow), inbreeding; genetic drift, an important evolutionary force; evolution of social behavior and kin selection; sexual selection; evolution of life history characters.

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

CORE COURSE XIV

LS/ZOO/CC-602 P

EVOLUTIONARY BIOLOGY

PRACTICALS

(Credits 2)

1. Study of fossils from models/ pictures
2. Study of homology and analogy from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis
4. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies
5. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.
6. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation
7. Construction of cladograms based on morphological characters.

SUGGESTED READINGS

- Ridley, M (2004) Evolution III Edition Blackwell publishing
- Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Bartlett Publishers.
- Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin Cummings.
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
- Snustad, S. Principles of Genetics.
- Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley Blackwell



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

DISCIPLINE SPECIFIC ELECTIVE COURSE

LS/ZOO/DSE-601(B) L

FISH AND FISHERIES

THEORY

(Credits 4)

Unit 1: Introduction and Classification

6

General characters of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction. Ornamental and weed fishes; Fin formula.

Unit 2: Morphology and Physiology

16

Different types of fins and scales; Use of scales in classification and determination of age of fish; Gills and gas exchange; Swim Bladder: types and role in respiration, buoyancy; Osmoregulation and ionic balance in fishes; Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminescence; Schooling; Parental care; Migration.

Unit 3: Fisheries

10

Inland Fisheries; Marine Fisheries; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations.

Unit 4: Aquaculture

16

Sustainable Aquaculture; Qualities of culturable species of fishes; Types of pond in a fish farm; Pen and cage culture; Integrated fish farming; Composite fish culture; Brood stock management; Induced breeding of fish; Hatchery, Preparation of compound diets for fish; Role of water quality in aquaculture; Fish by-products.

Unit 5: Fish Pathology and Cure

8

Sign of sickness in fishes, defensive devices in fishes against diseases, diseases of fishes: Nutritional diseases, bacterial disease (Infectious dropy, Tail rot or fin rot), Fungal diseases (Dermatomycoses, Branchiomycoses) and protozoan diseases (Ichthyophthiriasis, Costiasis).

Unit 6: Fish in research

4

Transgenic fish, Zebra fish as a model organisms in research.

Course Objectives:

To know about the diversity of fishes

To know about the edible and non-edible fish

To fulfill the great demands of nutritious food

To promote the fish industry basically based on fish byproducts

Course Outcomes:

Class Pisces is the largest group of the vertebrates. This group provides us highly nutritious food at the low cost. Fish byproducts are also used for various purposes. Therefore, it is utmost need in the present era to involve more and more people in the fish industry.

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

DISCIPLINE SPECIFIC ELECTIVE COURSE

LS/ZOO/DSE-601(B) P

FISH AND FISHERIES

PRACTICALS

(Credits 2)

1. Morphometric and meristic characters of fishes
2. Study of *Petromyzon*, *Myxine*, *Pristis*, *Chimaera*, *Exocoetis*, *Hippocampus*, *Gambusia*, *Labeo*, *Heteropneustes*, *Anabas*
3. Study of different types of scales (through permanent slides/ photographs).
4. Study of crafts and gears used in Fisheries
5. Study of air breathing organs in *Channa*, *Heteropneustes*, *Anabas* and *Clarias*
6. Study of ventilation rate of an air-breathing fish under different experimental conditions.
7. Determination of gonadosomatic index
8. Demonstration of induced breeding in Fishes (video)
9. Demonstration of parental care in fishes (video)
10. Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.

SUGGESTED READINGS

- Q Bone and R Moore, Biology of Fishes, Taylor and Francis Group, CRC Press, U.K.
- D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R.J. Mogilans and B.G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
- C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- J.R. Norman, A history of Fishes, Hill and Wang Publishers
- S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House


S.A. Bharti


S.K. Singh


Anurag