



### List of New Course(s) Introduced

**Department** : **Zoology**

**Programme Name** : **M.Sc.**

**Academic Year** : **2021-22**

### **List of New Course(s) Introduced**

Sr. No.	Course Code	Name of the Course
01.	LZT 303 F	Basic Epidemiology
02.	LZT 304 F	Clinical Epidemiology
03.	LZT 403 F	Molecular Markers and Genome Analysis
04.	LZT 404 F	Prenatal Diagnosis and Pre-implantation Genetics
05.	ZOPAT01	Fundamentals of Public Health
06.	ZOPAT02	Applied Zoology
07.	ZOPBTA1	Research Methodology

*A. V. K. Bhaskar*

विभागप्रमुख  
HEAD  
जन्तु विज्ञान विभाग  
Department of Zoology  
गुरु घासीदास वि.वि., बिलासपुर  
Guru Ghasidas Vishwavidyalaya, Bilaspur



## Minutes of Meetings (MoM) of Board of Studies (BoS)

**Academic Year : 2021-22**

**School : School of Studies of Life Sciences**

**Department : Zoology**

**Date and Time : 24 Dec, 2021 - 11:30 AM**

**Venue : Department of Zoology**

The scheduled meeting of member of Board of Studies (BoS) of Department of Zoology, School of Studies of Life Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur was held to design and discuss the M. Sc. Zoology (I to IV semesters) scheme and syllabi.

The following members were present in the meeting:

1. Prof. SK Prasad (External Expert Member BoS, Dept. of Biosciences., Pandit Ravishankar Shukla University)
2. Prof. LVKS Bhaskar (HOD, Prof., Dept. of Zoology.-cum Chairman, BOS)
4. Dr. Rohit Seth (Member BoS, Associate Professor, Dept. of Zoology)
5. Dr. Sushant Kumar Verma (Member, Assistant Professor, Dept. of Zoology)

Following points were discussed during the meeting

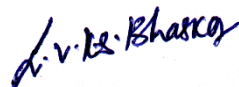
1. Papers of semester I to IV were thoroughly discussed and less than 20% modifications was approved by the BOS members in eight papers (04 core papers, 04 discipline specific Electives).
2. More than 20% modifications was suggested by the BOS members in seven core papers.
3. One new elective (Epidemiology and Molecular Genetics) was introduced in Discipline Specific Electives (DSE) in semester III and IV.
4. Two new open electives and one compulsory paper was introduced in semesters I and II for session 2021-22.

**The following new courses were introduced in M. Sc. Program for semesters III and IV:**

Sr. No.	Course Code	Name of the Course
01.	LZT 303 F	Basic Epidemiology (newly introduced)
02.	LZT 304 F	Clinical Epidemiology (newly introduced)
03.	LZT 403 F	Molecular Markers and Genome Analysis (newly introduced)
04..	LZT 404 F	Prenatal Diagnosis and Pre-implantation Genetics (newly introduced)

**The following new courses were introduced in M. Sc. Program for semesters I and II:**

01.	ZOPAT01	Fundamentals of Public Health
02.	ZOPAT02	Applied Zoology
03.	ZOPBTA1	Research Methodology

  
विभागप्रधान  
HEAD  
जन्तु विज्ञान विभाग  
Department of Zoology  
गुरु घासीदास वि.वि., बिलासपुर  
Guru Ghasidas Vishwavidyalaya, Bilaspur

Signature & Seal of HoD



## Scheme and Syllabus

### Semester-wise Theory Papers/ Practical: Masters of Science in Zoology

#### Department of Zoology, School of Life Science

Type of Course	Course Code	Title of the Course	Lecture-Tutorial-Practical / week	No. of credits	Continuous Comprehensive Assessment (CCA)	End-Semester Exam. (ESE)	Total
<b>Semester – I<sup>st</sup></b>							
Core Course 1	LZT 101	Comparative Anatomy of Vertebrates	4	4	40	60	100
Core Course 2	LZT 102	Cell Biology	4	4	40	60	100
Core Course 3	LZT 103	Reproduction and Developmental Biology	4	4	40	60	100
Core Course 4	LZT 104	Basic Mammalian Physiology	4	4	40	60	100
Core Course Practical 1	LZL 105	Lab. Exercises based on courses LZT 101 and 102	6	3	40	60	100
Core Course Practical 2	LZL 106	Lab. Exercises based on courses LZT 103 and 104	6	3	40	60	100
				<b>22</b>	<b>240</b>	<b>360</b>	<b>600</b>
<b>Semester II<sup>nd</sup></b>							
Core Course 5	LZT 201	Biochemistry and Molecular Biology	4	4	40	60	100
Core Course 6	LZT 202	Regulatory Mammalian Physiology	4	4	40	60	100
Core Course 7	LZT 203	Endocrinology	4	4	40	60	100
Core Course 8	LZT 204	Biotechniques	4	4	40	60	100
Core Course Practical 3	LZL 205	Lab. Exercises based on course LZT 201 and 202	6	3	40	60	100
Core Course Practical 4	LZL 206	Lab. Exercises based on course LZT 203 and 204	6	3	40	60	100
				<b>22</b>	<b>240</b>	<b>360</b>	<b>600</b>
<b>Semester III<sup>rd</sup></b>							
Core Course 9	LZT 301	Molecular Genetics	4	4	40	60	100
Core Course 10	LZT 302	Animal Behavior	4	4	40	60	100

*S. K. Singh*

*J. K. Sharma*

*Sharma*



DSE: A <i>Biochemistry and Molecular Biology</i>	LZT 303A	Biochemistry of Intermediary Metabolism	4	4	40	60	100
DSE: A <i>Biochemistry and Molecular Biology</i>	LZT 304A	Molecular Biology of Information Pathway: Nucleic Acids	4	4	40	60	100
DSE: B <i>Mammalian Reproductive Physiology and Endocrinology</i>	LZT 303B	Neuroendocrinology and Non-Classical Hormones	4	4	40	60	100
DSE: B <i>Mammalian Reproductive Physiology and Endocrinology</i>	LZT 304B	Male and Female Reproduction	4	4	40	60	100
DSE: C <i>Fish Biology</i>	LZT 303C	Fish Culture and Pathology	4	4	40	60	100
DSE: C <i>Fish Biology</i>	LZT 304C	Fish Anatomy and Physiology	4	4	40	60	100
DSE: D <i>Neuroscience</i>	LZT 303D	Brain and Neuron	4	4	40	60	100
DSE: D <i>Neuroscience</i>	LZT 304D	Developmental Neurobiology	4	4	40	60	100
DSE: E <i>Toxicology</i>	LZT 303E	Occupational and Environmental Toxicity	4	4	40	60	100
DSE: E <i>Toxicology</i>	LZT 304E	Mechanism of Toxicology	4	4	40	60	100
DSE: F <i>Epidemiology and Molecular Genetics</i>	LZT 303F	Basic Epidemiology	4	4	40	60	100
DSE: F <i>Epidemiology and Molecular Genetics</i>	LZT 304F	Clinical Epidemiology	4	4	40	60	100
Core Course Practical 5	LZL 305	Lab. Exercises based on courses LZT 301 and 302	6	3	40	60	100
DSE Practical (Elective)	LZL 306	Lab. Exercises based on courses LZT 303 and 304 (A-F)	6	3	40	60	100
				22	240	360	600

Semester IV<sup>th</sup>

Core Course 11	LZT 401	Evolution and Environmental Biology	4	4	40	60	100
Core Course 12	LZT 402	Biostatistics OR Discrete Data Analysis: MOOC	4	4	40	60	100
DSE: A <i>Biochemistry and Molecular</i>	LZT 403A	Protein and Enzymology	4	4	40	60	100

(S) Singh

SK. Sharma

Sharma

Sharma

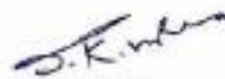


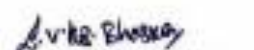
<i>Biology</i>							
DSE: A <i>Biochemistry and Molecular Biology</i>	LZT 404A	Medical Biochemistry	4	4	40	60	100
DSE: B <i>Mammalian Reproductive Physiology and Endocrinology</i>	LZT 403B	Hormone Receptors and Signaling Mechanism	4	4	40	60	100
DSE: B <i>Mammalian Reproductive Physiology and Endocrinology</i>	LZT 404B	Fertility and Sterility	4	4	40	60	100
DSE: C <i>Fish Biology</i>	LZT 403C	Fish Reproduction, Genetics and Biotechnology	4	4	40	60	100
DSE: C <i>Fish Biology</i>	LZT 404C	Capture Fishery	4	4	40	60	100
DSE: D <i>Neuroscience</i>	LZT 403D	Cellular Neurophysiology and Neurochemistry	4	4	40	60	100
DSE: D <i>Neuroscience</i>	LZT 404D	Sensory, Motor and Regulatory Systems	4	4	40	60	100
DSE: E <i>Toxicology</i>	LZT 403E	Mechanism of Toxicity	4	4	40	60	100
DSE: E <i>Toxicology</i>	LZT 403E	Systemic Toxicity	4	4	40	60	100
DSE: F <i>Epidemiology and Molecular Genetics</i>	LZT 403F	Molecular Markers and Genome Analysis	4	4	40	60	100
DSE: F <i>Epidemiology and Molecular Genetics</i>	LZT 404F	Prenatal Diagnosis and Pre-Implantation Genetics	4	4	40	60	100
DES Dissertation	LZL 405	Project work / Dissertation	12	6	80	120	200
				22	240	360	600

1. Discipline Specific Electives (DSE) for each session will be offered to students on the basis of availability of faculty and infrastructure.
2. Offering of DSE in any particular session will be decided after a formal meeting of faculty members of Department of Zoology.
3. Each student may elect any one out of the given electives (A, B, C, D, E and F).
4. Elective papers will be distributed among the students on the basis of merit/choice. The project work/dissertation will be carried out only in the field of respective elective papers (A, B, C, D, E and F) opted by the students.

  
Prof. S K Prasad  
(External Expert)

  
Dr. Rohit Seth  
(Member)

  
Dr. S K Verma  
(Member)

  
Prof. LVKS Bhaskar  
(HOD)



Department of Zoology, GGV, Bilaspur (CG)

SEMESTER III

**Major Elective Course F: Epidemiology and Molecular Genetics**  
**L.ZT 303F: BASIC EPIDEMIOLOGY**

**Unit 1: Epidemiology:** Historical context, Definition, scope, and uses of epidemiology; Epidemiology and public health; Achievements in epidemiology. Special features of environmental and occupational epidemiology.

**Unit 2: Measuring health and Disease:** Definition of health and disease; Epidemic and endemic disease, Investigation and control of epidemics, Measures of disease; Using secondary data, death rates morbidity; Comparing disease occurrence; Prevalence and Incidence.

**Unit 3: Types of Epidemiological Study:** Observations and experiments, Observational studies, Descriptive studies: Ecological studies, Ecological fallacy, Cross-sectional, Case-Control, Cohort studies; Experimental studies: Randomized controlled trials, Field trials, Community trials.

**Unit 4: Errors in Epidemiology:** Potential errors in epidemiological studies: Random error, Systematic error, Measurement bias, confounding, validity, Ethical issues.

**Unit 5: Causation and Prevention in Epidemiology:** Concept of cause, Establishing the cause of a disease; Diagnostic tests, Natural history and prognosis Scope of prevention, Levels of prevention, Screening, Sensitivity, Specificity, PPV and NPV; Prevention in clinical practice.

**References Books**

1. Beaglehole et al. (1998) Basic Epidemiology, WHO, Geneva.
2. Farmer R and Miller D (1991) Lecture notes on Epidemiology and Public Health Medicine. 3<sup>rd</sup> Ed. Blackwell Scientific Publications.
3. Bharath, R (2008) Basic concepts in statistics and epidemiology. Choice: Current Reviews for Academic Libraries, 45(6), pp.1012-1012.
4. Bourgeois JP (2016) Basic statistics and epidemiology: a practical guide. 4<sup>th</sup> Ed. Choice: Current Reviews for Academic Libraries, 54(4), pp.572-572.
5. Geck C (2008) Encyclopedia of Epidemiology, Reference & User Services Quarterly, 48(1), pp.89-90.
6. Jacobsen KH (2011) Epidemiology and the people's health; theory and context. Choice: Current Reviews for Academic Libraries, 49(2), pp.343-343.
7. Philipp and Gardiner (1991) WHO's who in environmental epidemiology. Aslib Proceedings, 43(1), pp.13-17.
8. Arcari RD (2010) Eras in epidemiology: the evolution of ideas. Choice: Current Reviews for Academic Libraries, 47(8), pp.1516-1516.

**Course objectives:** To understand the basic epidemiological methods and study designs to examine disease and health-related events. Further, this course discusses basic concepts of screening and outbreak investigations.

**Course outcome:** Students become familiar with epidemiologic terminology, outcome measures, and study designs; to appreciate application of epidemiology to current public health issues.

(SF)

SK

Blas



Department of Zoology, GGV, Bilaspur (CG)

SEMESTER III

Major Elective Course F: Epidemiology and Molecular Genetics  
LZT 304F: CLINICAL EPIDEMIOLOGY

**Unit 1: Population Genetics:** The principles of population genetics: allele frequencies, spectrum of allele frequencies, Hardy Weinberg Equilibrium, linkage disequilibrium, genetic diversity and measures of diversity, Wright-Fisher model, coalescence theory, inbreeding, population structure and selection.

**Unit 2: Genetic Disorders:** Aneuploides-Down's, Patau's, Edward's, Klinefelter's and Turner's Syndromes-Genetics and clinical features. Duchene muscular dystrophy, Cystic fibrosis, Huntington's disease, Fragile X-syndrome, Phenylketonuria, Glucose 6-phosphate dehydrogenase deficiency.

**Unit 3: non-communicable diseases Epidemiology:** Common non-communicable diseases (NCDs), genetic, genomic factors and epigenetic factors. Pathophysiology of major NCDs. Factors influencing chronic diseases, Cancer epidemiology, Obesity epidemiology and diabetes epidemiology. National strategies for control of NCDs.

**Unit 4: Infectious disease Epidemiology:** infectious diseases, outbreak investigations, disease surveillance, dynamics of transmission, assessment of vaccines and vaccine efficacy. Epidemiology of Sexually transmitted diseases, HIV, diarrheal diseases, hepatitis, tuberculosis and malaria.

**Unit 5: Social determinants of health:** Poverty, discrimination, vulnerability, income inequality and impact on health outcome, measuring poverty, measuring health inequalities. Public health strategies to reduce health disparities

References Books

1. Nielsen et al. (2013) An introduction to population genetics: theory and applications. Sunderland, Mass. Sinauer Associates.
2. Gilson L (2012) Alliance for Health Policy and Systems Research, WHO Health policy and systems research: a methodology reader.
3. WHO (2013-2020) Global Action Plan for the Prevention and Control of Non-Communicable Diseases, WHO, Geneva, Switzerland.
4. Hartl DL and G AC (2007) Principles of Population Genetics, 4<sup>th</sup> Ed. Sinauer Associates, Sunderland, MA.
5. Gupta RP (2016) Health Care Reforms in India: Making Up for the Lost Decades. Elsevier.
6. WHO (2009). Systems Thinking for Health Systems Strengthening. Alliance Flagship report series. Alliance for Health Policy and Systems Research.
7. WHO (2016). Global Report on Diabetes. WHO Press, Switzerland
8. WHO: Report on infectious diseases, and Report on Multidrug resistance, WHO, Geneva

**Course Objective:** The course intends to give basic knowledge about the population genetics as well as the importance of genetic, environmental and social determinants of origin of non-communicable and infectious diseases.

**Course Outcome:** On completion of the course, the students know and are able to use basic genetic concepts and identify Mendelian inheritance patterns. Further students become familiar with different genetic and environmental factors that are important for the origin of both communicable and non-communicable diseases.

(SK)

SK  
Bhavsar

Alwara



Department of Zoology, GGV, Bilaspur (CG)

SEMESTER IV

Major Elective Course F: Epidemiology and Molecular Genetics

LZT 403F: MOLECULAR MARKERS AND GENOME ANALYSIS

**Unit 1: Genome Organization:** Nuclear and mitochondrial genomes; Unique and repeat DNA sequences; Classification of Repeat elements: Tandem, Interspersed, Micro-satellites, minisatellites, hyper-variability of VNTRs.

**Unit 2: Molecular markers:** DNA based markers: Molecular basis of dominant and co-dominant markers, hybridization based markers: Restriction Fragment Length Polymorphism and PCR based markers: Randomly Amplified Polymorphic DNA, SSRs, SCARs, Inter-SSRs, Amplified Fragment Length Polymorphism, Microsatellite Polymorphic Loci, SNPs and based marker assays, high-throughput genotyping techniques: genotyping by sequencing, Diversity Array Technology (DArTs).

**Unit 3: Applications of marker technology:** Assessment of genetic diversity: Introduction to population diversity, Y-chromosomal markers, mitochondrial markers; Role of molecular markers in disease diagnosis and prognosis; Application of molecular marker technology in species identification; Neonatal and Prenatal disease diagnostics; Gender identification using amelogenin gene locus; Amplification of Y chromosome specific Short Tandem Repeats (Y-STR); Analysis of mitochondrial DNA for maternal inheritance.

**Unit 4: Molecular diagnosis:** History, scope and Significance of Molecular diagnosis; Current trends and recent developments of molecular diagnosis; Genetic diagnosis of cancers and other hereditary diseases.

**Unit 5: Molecular Markers of Infectious Diseases:** Traditional disease diagnosis methods and tools; Diagnosis of infection caused by Streptococcus, Coliforms, Salmonella, Shigella, Vibrio, and Mycobacterium; Diagnosis of fungal infections. Major fungal diseases: Candidiosis and Aspergillosis; Diagnosis of DNA and RNA viruses- Pox viruses, Adenoviruses, Hepatitis Viruses and Retroviruses.

Books Recommended

1. Coleman and Tsongalis (2006) Molecular Diagnostics for the Clinical Laboratorian, 2<sup>nd</sup> Ed. Humana Press
2. Debra GB (2007) Leonard: Molecular Pathology in Clinical Practice.
3. Brooks et al. (2004) Stephen A. Morse, Janet S. Butel, Janet S. Butel, Jawetz, Melnick, & Adelberg's Medical Microbiology
4. Bruns et al. (2007) Fundamentals of Molecular Diagnostics, Saunders Group.
5. Malacinski (2005) Freifelder's Essentials of Molecular Biology, 4<sup>th</sup> Ed. Narosa.
6. Jones and Bartlett (2008) Lewin: Genes IX.
7. Brown (2006) Genomes, 3<sup>rd</sup> Ed. Garland Science
8. Brown (2001) Gene Cloning and DNA Analysis, Blackwell.

**Course Objective:** The course goal is to familiarize students with the application of molecular information to diagnose the diseases. The course will also review the applications of molecular markers in disease diagnosis and therapy of various genetic and infectious diseases.

**Course outcome:** By the end of the semester, students should be able to describe genome organization and applications of Genomic markers to health and disease. Ultimately, students should be able to identify different markers and their application in population genetics as well as disease diagnosis.





Department of Zoology, GGV, Bilaspur (CG)

SEMESTER IV

Major Elective Course F: Epidemiology and Molecular Genetics

LZT 404F: PRENATAL DIAGNOSIS AND PRE-IMPLANTATION GENETICS

**Unit 1: Prenatal Diagnosis:** Indications, Non-invasive PND; Ultra sound markers for fetal abnormalities Invasive methods of PND; Recent advances in PND; Current knowledge of prenatal diagnosed genetic disorders, treatment: current practices and future prospectus.

**Unit 2: Clinical Genetics and Genetic Counseling:** Principles and practice, case management in genetic counseling; Genetic Counseling for PND; Dysmorphology and clinical teratology.

**Unit 3: Genetics and Society:** Population screening for genetic disease, Bioethics and medical genetics. Medical ethics in India and abroad; Fetal rights Ethics: Ethics and laws in prenatal, pre-implantation genetics, *In vitro* fertilization, Stem Cell Biology, Human reproduction, Genetic registries, DNA fingerprinting and paternity testing Animal handling; Future Medical ethics in India and abroad.

**Unit 4: Assisted Reproductive Technology:** Introduction, Clinical *in vitro* fertilization, Semen analysis and Preparation for Assisted reproductive techniques Oocyte retrieval and embryo culture, Cryopreservation, Micromanipulation techniques.

**Unit 5: Gene Therapy:** Molecular Cytogenetics, Molecular characterization of Stem cells; Introduction and role of gene manipulation in rectifying genetic defects; Genetically modified stem cells in experimental Gene therapy.

Reference Books

1. Keper BA (2019) A Comprehensive Guide to Genetic Counseling, (Nova Science Publishers, Inc., New York.
2. Mathiesen and Rey (2018) Foundations of Perinatal Genetic Counseling, Oxford University Press, Oxford, New York.
3. Fischmann and Hilit (2011) Ethical Dilemmas in Prenatal Diagnosis, Springer, New York.
4. Newman and Kohn (2019) Evidence-based diagnosis : an introduction to clinical epidemiology, Cambridge University Press, Cambridge, New York.
5. Yashon and Cummings (2012) Human Genetics and Society, Brooks/Cole, Australia; Belmont, CA.
6. Kissin et al. (2019) Assisted Reproductive Technology Surveillance, Cambridge University Press, Cambridge, United Kingdom.
7. Stevenson and Hershberger (2016) Fertility and Assisted Reproductive Technology (ART): theory, research, policy, and practice for health care practitioners, Springer Publishing Company, New York.
8. Putno (2011) Gene Therapy: Treatments and Cures for Genetic Diseases, Facts On File, New York.

**Course objectives:** The course goal is to familiarize students with the application of molecular information to diagnose the diseases. To an overview of various assisted reproductive techniques such as *in vitro* fertilization, embryo culture, Cryopreservation, Micromanipulation techniques.

**Course outcome:** By the end of the course, students should be able to know common genetic abnormalities, integrating the various modalities of investigation for perinatal diagnosis. Further, students will develop unique skill set of a genetic counselor, which could be applied across practice settings.

47



**Post Graduate Program: M. Sc. Zoology (CBCS)  
Offered by the Department of Zoology, School of Life Sciences**

1. Name of the Program : Master of Science in Zoology
2. Specializations available : Biochemistry and Molecular Biology,  
Fish Biology,  
Mammalian Reproductive Physiology and Endocrinology, and  
Toxicology.
3. Program Specifications  
School of studies: School of Life Sciences  
Department: Department of Zoology  
Program: M.Sc. in Zoology  
Date of approval in Board of Studies: 24/12/2021
4. Mode of study: Full time (semester system)  
Class room teaching; experiential learning; tutorials; project  
assignments and dissertation work.

**Purpose of the Program:**

The Master of Science degree program in Zoology provides students the opportunity to enhance their knowledge and competence in the diverse field of animal science and encourages students to get indulged in the subject. Another focus of this program is to motivate students towards research. Students are encouraged to get involved in dissertation projects under the guidance of faculty mentors that address topics related to animal health, environment, nutrition, physiology, production, and behavior. The attainment of a master's degree also qualifies students to pursue further specialized training and gain entrance to professional schools, or to pursue a doctorate.

**Learning outcomes:**

- Students will be able to identify the major groups of organisms with an emphasis on animals and be able to classify them within a phylogenetic framework.
- Students will be able to compare and contrast the characteristics of animals that differentiate them from other forms of life.
- Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth.
- Students will be able to understand the concepts of physiology, nutrition, health and economics with reference to animals.
- Students will be able to explain the mechanisms and role of reproductive physiology, Immunology, toxicology & neurobiology in health & disease
- Students will be able to apply the scientific method to questions in biology by formulating testable hypotheses, gathering data that address these hypotheses, and analyzing those data and will be able to demonstrate critical thinking and problem solving skills in Biostatistics course.
- Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.
- Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

Bhans

Rau

ii

S.K. Singh



Semester-wise Theory Papers/ Practical  
Masters of Science in Zoology (CBCS)  
Department of Zoology, School of Life Science

Course Opted	Course Code	Name of the Course	T-L-D /Week	Credits	CCA	ESE	Total
<b>Semester - I<sup>st</sup></b>							
CC 1	ZOPATT1	Comparative Anatomy of Vertebrates	T-3	3	30	70	100
CC 1	ZOPALT1	Comparative Anatomy of Vertebrates	L-4	2	15	35	50
CC 2	ZOPATT2	Cell Biology	T-3	3	30	70	100
CC 2	ZOPALT2	Cell Biology	L-4	2	15	35	50
CC 3	ZOPATT3	Endocrinology	T-3	3	30	70	100
CC 3	ZOPALT3	Endocrinology	L-4	2	15	35	50
OE 1	ZOPATO1	To be drawn from the pool of OE	T-3	3	30	70	100
OE 1	ZOPALO1	To be drawn from the pool of OE	L-4	2	15	35	50
	*Certificate	UACE, VAC, CC, OCC and others offered by university					
			28H/W	20	180	420	600
<b>Semester II<sup>nd</sup></b>							
CC 4	ZOPBTT1	Biochemistry and Molecular Biology	T-3	3	30	70	100
CC 4	ZOPBLT1	Biochemistry and Molecular Biology	L-4	2	15	35	50
CC 5	ZOPBTT2	Basic Mammalian Physiology	T-3	3	30	70	100
CC 5	ZOPBLT2	Basic Mammalian Physiology	L-4	2	15	35	50
CC 6	ZOPBTT3	Animal behavior	T-3	3	30	70	100
CC 6	ZOPBLT3	Animal behavior	L-4	2	15	35	50
DSE: 1	ZOPBTD1	Molecular Genetics	T-3	3	30	70	100
DSE: 1	ZOPBLD1	Molecular Genetics	L-4	2	15	35	50
RM	ZOPBTA1	Research Methodology	T-2	2	30	70	100
	*Certificate	UACE, VAC, CC, OCC and others offered by university					
			30H/W	22	210	490	700
<b>Semester III<sup>rd</sup></b>							
CC 7	ZOPCTT1	Developmental Biology	T-3	3	30	70	100
CC 7	ZOPCLT1	Developmental Biology	L-4	2	15	35	50
CC 8	ZOPCTT2	Regulatory Mammalian Physiology	T-3	3	30	70	100
CC 8	ZOPCLT2	Regulatory Mammalian Physiology	L-4	2	15	35	50
CC 9	ZOPCTT3	Evolution, Environmental Biology and Sustainable Development	T-3	3	30	70	100
CC 9	ZOPCLT3	Evolution, Environmental Biology and Sustainable Development	L-4	2	15	35	50
DSE: 2	ZOPCTD1	Brain function and Mental Awareness	T-3	3	30	70	100
DSE: 2	ZOPCLD1	Brain function and Mental Awareness	L-4	2	15	35	50
	*Certificate	UACE, VAC, CC, OCC and others offered by university					
			28H/W	20	180	420	600
<b>Semester IV<sup>th</sup></b>							
CC 10	ZOPDTT1	Biotechniques	T-3	3	30	70	100

Blaw

Blaw  
Blaw  
Blaw



Department of Zoology, GGV, Bilaspur (CG)

**SEMESTER I**  
**OPEN ELECTIVE I**

**ZOPATO1: FUNDAMENTALS OF PUBLIC HEALTH**

**Unit 1: Concepts of Health:** Concepts of Health & Disease; Dimensions of Health: Physical dimension, Mental dimension, Social dimension, Spiritual dimension, Emotional dimension, Vocational dimension; Outbreaks, epidemics and pandemics; History of public health; Determinants of Health; Indicators of Health.

**Unit 2: Measuring Health and disease:** Causation of diseases; Risk measurement, Measurement of morbidity and mortality: Incidence, Prevalence, Age-adjustment and survival analysis, use of morbidity and mortality; Comparing disease occurrence: Risk difference, Attributable fraction, Population attributable risk, Relative risk, Attributable risk.

**Unit 3: Epidemiology of infectious diseases:** Infectious diseases; agent biology, epidemiology, pathogenesis and pathology, clinical presentation and management; public health strategies and mechanisms.

**Unit 4: Inequalities and Disparities in Health:** Poverty, discrimination, vulnerability, income inequality and impact on health outcome, measuring poverty, measuring health inequalities.

**Unit 5: National Health Programs:** National Rural Health Mission, National Vector Borne Disease Control Program, Malaria eradication program, Reproductive and Child Health Program, National AIDS Control Program, Revised National Tuberculosis Control Program, National Leprosy Eradication Program, National Program for Control of Blindness, National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke, Integrated Management of Neonatal and Childhood Illness.

**Books Recommended**

1. Berkman LF, Kawachi I & Glymour MM. Social Epidemiology. New York: Oxford University Press, 2014.
2. Nambiar Devaki, Arundati Muralidharan The social determinants of health in India: concepts, processes, and indicators. Springer Publication. New Delhi. 2017
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Nelson K E: Infectious disease epidemiology: theory and practice
5. Giesecke J: Modern infectious disease epidemiology
6. Green J, Thorogood J, Qualitative methods for Health research, Sage Pub, 2004
7. Catherine Pope, Nicholas Mays, Qualitative Research in Health Care. John Wiley & Sons, 2008
8. Collins, C., Green, A., 2014. Valuing Health Systems: A Framework for Low and Middle-Income Countries. SAGE Publications.
9. Gupta, R.P., 2016. Health Care Reforms in India: Making Up for the Lost Decades. Elsevier India.

Percent Change From Previous Syllabus: 100 % (Newly introduced)

*Shukla*      7      *Shukla*      *S.K. Sharma*



Department of Zoology, GGV, Bilaspur (CG)

**SEMESTER I**  
**OPEN ELECTIVE 2**

**ZOPATO2: APPLIED ZOOLOGY**

**Unit 1: Introduction to Host-parasite Relationship:** Host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis.

**Unit 2: Parasitic Protozoa & Helminthes:** Life history and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense*. Parasitic life history and pathogenicity of *Ancylostoma duodenale* and *Wuchereria bancrofti*.

**Unit 3: Insects of Economic Importance:** Biology, damage and control caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Collasabrochus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*.

**Unit 4: Insects of Medical Importance:** Medical importance and control of *Pediculus* (head louse), *Anopheles*, *Culex* and *Aedes* mosquitoes, *Xenopsylla cheopis*.

**Unit 5: Poultry farming and Fish technology:** Principles of poultry breeding, Management of breeding stock and broilers. Processing and preservation of eggs; Major and minor carps of economic importance; Induced breeding and transportation of fish seed.

**Books Recommended**

1. Park, K. Preventive and Social Medicine. XVI Edition. B.B Publishers. (2007)
2. Arora, D. R and Arora, B. Medical Parasitology. II Edition. CBS Publications and Distributors. (2001)
3. Kumar, Robbins & Cotran. Pathologic Basis of Disease. Elsevier; 9th edition. (2014)
4. Atwal, A.S. Agricultural Pests of India and South East Asia, Kalyani Publishers. (1986)
5. Dennis, H. Agricultural Entomology. Timber Press (OR). (2009)
6. Dunham R.A. Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K. (2004)
7. Pedigo, L.P. Entomology and Pest Management, Prentice Hall. (2002)
8. Shukla and Upadhyay. Economic Zoology. Rastogi Publication (2016)
9. Jhingran, V.G. Fish and fisheries of India, Hindustan Publishing Corporation (1997)
10. Khanna. S.S, An introduction to fish biology and fisheries. Surjeet Publication (2019)
11. K.P. Shrivastava, G.S. Dhaliwal. A textbook of Applied Entomology. Kalyani Publication (2013)

Percent Change From Previous Syllabus: 100 % (Newly Introduced)

*[Signature]*

*[Signature]*

*[Signature]*



Department of Zoology, GGV, Bilaspur (CG)

**SEMESTER II  
COMPULSORY PAPER**

**ZOPBTA1: RESEARCH METHODOLOGY**

**Unit 1: Introduction to research**

Meaning of research, objectives of research, research process, criteria of good research, defining the research problem, basic principles of research design, developing a research plan

**Unit 2: Basics of scientific communication**

Types of scientific communication: research papers, review, letter to editor; Constituents of research paper: title, running title, authorships, abstracts, keywords, introduction, materials and methods, results, discussion, acknowledgements, referees, figures, table components, communication with the editors, handling referees comments, galley proofs; Plagiarism.

**Unit 3: Research ethics involving human participants or laboratory animals**

Ethics and biomedical research: General principles on ethical considerations involving human subjects. Institutional ethics committee: its organization and functions, general ethical issues. Ethical guidelines for experimental animals: Sources of experimental animals, anesthesia and euthanasia, laboratory animal ethics, animal ethics committee, its organization and functions, ethical guidelines for use of animals for scientific research, CPCSEA guidelines.

**Unit 4: Data analysis for statistics**

Methods of data collection; Graphical representation of data; Measurement of central tendency: Definition, characteristics, types, merits and demerits; Measurement of dispersion: Range, Mean deviation, Standard deviation, Standard error.

**Unit 5: Statistical analysis**

Variance, Coefficient of variation, Correlation and Regression and their coefficients; Test of significance: Student t-test, Chi-square test; ANOVA; Elementary idea of probability.

**Suggested readings**

1. National Ethical Guidelines for Biomedical and Health Research involving human participants ICMR, New Delhi 2017.
2. Guidelines for care and use of animals in scientific research. Indian National Science Academy, New Delhi.
3. Research Methodology, methods and techniques by C.R. Kothari (2009).
4. Biostatistics: A foundation for analysis in health sciences, 9<sup>th</sup> Ed. Wayne W Daniel (2008).
5. Computer fundamentals, Pradip K Singha and Priti Singha (BPB Publication).

Percent Change From Previous Syllabus: 100 % (Newly introduced)