



### List of Revised Courses

Department : **Zoology**

Programme Name : **M. Sc**

Academic Year : **2021-22**

### List of Revised Courses

| Sr. No. | Course Code | Name of the Course                            |
|---------|-------------|---|
| 01.     | LZT 301     | Molecular Genetics                            |
| 02.     | LZT 302     | Animal Behaviour                              |
| 03.     | LZT 303 E   | Occupational and Environmental Toxicity       |
| 04.     | LZT 303 B   | Neuroendocrinology and Non-Classical Hormones |
| 05.     | LZT 401     | Evolution and Environmental Biology           |
| 06.     | LZT 402     | Biostatistics OR Discrete Data Analysis       |

*A. V. K. Bhasra*

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Department of Zoology  
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Guru Ghasidas Vishwavidyalaya, Bilaspur



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

**Academic Year : 2021-22**

**School : School of Studies in 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. scheme and syllabi.

The following members were present in the meeting:

1. Prof. Shivkant Kumar Prasad (External Expert Member BoS, Dept. of Biosciences, Pandit Ravishankar Shukla University).
3. Prof. LVKS Bhaskar (HOD, 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)

The committee discussed and approved the scheme and syllabi. The following courses were revised in M. Sc. Zoology (I to IV Semesters) session 2021-22:

**Sr. No. Course Code Name of the Course**

|     |           |   |
|-----|-----------|---|
| 01. | LZT 301   | Molecular Genetics                            |
| 02. | LZT 302   | Animal Behaviour                              |
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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 – 1<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        |

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J.F. Singh

D. Singh



|  |          |   |   |    |     |     |     |
|--|----------|---|---|----|-----|-----|-----|
| DSE: A<br><i>Biochemistry and Molecular Biology</i>                  | LZT 303A | Biochemistry of Intermediary Metabolism                 | 4 | 4  | 40  | 60  | 100 |
| DSE: A<br><i>Biochemistry and Molecular Biology</i>                  | LZT 304A | Molecular Biology of Information Pathway: Nucleic Acids | 4 | 4  | 40  | 60  | 100 |
| DSE: B<br><i>Mammalian Reproductive Physiology and Endocrinology</i> | LZT 303B | Neuroendocrinology and Non-Classical Hormones           | 4 | 4  | 40  | 60  | 100 |
| DSE: B<br><i>Mammalian Reproductive Physiology and Endocrinology</i> | LZT 304B | Male and Female Reproduction                            | 4 | 4  | 40  | 60  | 100 |
| DSE: C<br><i>Fish Biology</i>  | LZT 303C | Fish Culture and Pathology                              | 4 | 4  | 40  | 60  | 100 |
| DSE: C<br><i>Fish Biology</i>  | LZT 304C | Fish Anatomy and Physiology                             | 4 | 4  | 40  | 60  | 100 |
| DSE: D<br><i>Neuroscience</i>  | LZT 303D | Brain and Neuron  | 4 | 4  | 40  | 60  | 100 |
| DSE: D<br><i>Neuroscience</i>  | LZT 304D | Developmental Neurobiology                              | 4 | 4  | 40  | 60  | 100 |
| DSE: E<br><i>Toxicology</i>  | LZT 303E | Occupational and Environmental Toxicity                 | 4 | 4  | 40  | 60  | 100 |
| DSE: E<br><i>Toxicology</i>  | LZT 304E | Mechanism of Toxicology                                 | 4 | 4  | 40  | 60  | 100 |
| DSE: F<br><i>Epidemiology and Molecular Genetics</i>                 | LZT 303F | Basic Epidemiology                                      | 4 | 4  | 40  | 60  | 100 |
| DSE: F<br><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 |
| <b>Semester IV<sup>th</sup></b>                                      |          |   |   |    |     |     |     |
| 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<br><i>Biochemistry and Molecular</i>                          | LZT 403A | Protein and Enzymology                                  | 4 | 4  | 40  | 60  | 100 |

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Department of Zoology, GGV, Bilaspur (CG)

SEMESTER III

LZT 301: MOLECULAR GENETICS

**Unit 1: Classical genetics:** Properties and evolution of genetic material flow of genetic information; Mendel's laws and their chromosomal basis of inheritance; Extensions of Mendelian principles: Dominance relationships, epistasis, pleiotropy, expressivity and penetrance; Linkage and crossing over; Sex linked, sex-limited and sex influenced character; Sex determination; dosage compensation in *Drosophila*.

**Unit 2: Modern gene concept:** Concepts of transcriptome and proteome, gene duplication-gene families, interrupted gene, pseudogenes and transposable genetic element; Regulation of gene activity in *lac* and *trp* operons of *E. coli*; Introduction to gene regulation in eukaryotes; Organization of a typical eukaryotic gene.

**Unit 3: Gene mutation:** Types and molecular basis, manipulation of genes, site-specific mutagenesis, reporter genes expression, genomic expression profiling; Methods for detection of induced mutations; Methods of gene mapping: 2 and 3- point test cross in *Drosophila*, Gene mapping in human by linkage analysis in pedigrees, ordered and unordered tetrad analysis.

**Unit 4: RNA interference:** siRNA, shRNA, miRNA; Therapeutic use of RNA interference. Detection of sickle cell anemia, thalassemia, cystic fibrosis, haemophilia, muscular dystrophy; Gene therapy: *Ex vivo* and *in vivo* therapy, strategies and delivery.

**Unit 5: Applications and Implications of genetic engineering:** Restriction enzymes, cloning vectors; production of recombinant DNA molecules; Preparation and screening of cDNA library; DNA sequencing: PCR and RT PCR; Gene transfer and transfection methods, transgenic animal production-DNA integration; Use of *cre/loxP* in transgenic animal production; Somatic cloning.

**Books Recommended**

1. Brown (2006) Genomes, 3<sup>rd</sup> Ed. Garland Science.
2. Gardner et al (2006) Principles of Genetics, John Wiley.
3. Griffith et al (2008) Modern Genetic Analysis, Freeman.
4. Karp (2010) Cell and Molecular Biology, John Wiley and Sons.
5. Krebs et al (2011) Lewin's Genes X, Jones and Bartlett.
6. Lewin (2010) Genes X, Jones and Bartlett.
7. Lodish et al (2008) Molecular Cell Biology, Freeman.
8. Pierce (2012) Genetics - A Conceptual Approach, Freeman.

**Percent Change From Previous Syllabus: 50.0 %**

**Course Objective:**

To study the Mendelian genetics, linkage analysis, genetic engineering, methods of cloning and their use, analysis of pedigree.

**Course Outcomes:**

Students will understand the basis of genetics through Mendelian genetics.  
Develop in-depth knowledge of how genes are arranged in a chromosome, develop understanding about pedigree analysis, cloning techniques and lethal genetic disorder.  
Students will develop understanding about how we can produce an organism with desired genome.

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Department of Zoology, GGV, Bilaspur (CG)

SEMESTER III

**LZT 302: ANIMAL BEHAVIOUR**

**Unit 1: Introduction to animal behavior:** History of the study of animal behaviour; Patterns of behavior; Genetic basis of behavior; Development of bird song; Learned behavior and types of learning.

**Unit 2: Specific behavior pattern:** Habitat selection and foraging behavior; Animal signals and communication; Social dominance and concept of territoriality; Fixed action pattern-characteristics and evolutionary features; Mimicry; mimetic releaser and code breakers.

**Unit 3: Control of behavior (a):** Neural control: Control of hippocampal pyramidal cell discharges; Perceptual mechanisms: Behavioral and cellular responses to novel and repeated stimuli; Motivational systems: Neural mechanisms involved in a cat's attack on a rat; Hypothalamic mechanisms for motivational and species-Typical behavior; Behavior of hippocampal neurons during conditioning.

**Unit 4: Control of behavior (b):** Hormonal control: Hormones classes: Peptides or proteins, steroids, monoamines and lipid based hormones. Hormonal control of social behavior; Hormonal control of behaviour in a lizard; Pheromonal regulations and biological rhythms.

**Unit 5: Parental care, mating and courtship behavior, altruism:** Parental care; Sexual selection: intra sexual selection (male rivalry); inter-sexual selection (female choice); sperm competition; mateguarding; consequences of mate choice for female fitness; monogamous versus polygamous sexual conflict; Reciprocal altruism; group selection; kin selection and inclusive fitness; Sociality in animal systems; Social organization in honey bees.

**Books recommended:**

1. Alcock (2009) Animal Behaviour: An Evolutionary Approach, 9<sup>th</sup> Ed, Sinauer Asso.
2. Kaushik M P (2015) Animal Behaviour, Kalyani Publication.
3. Mathur R (2005) Animal Behaviour, Rastogi Publications.
4. Richard et al (2013) Thompson: The Neural Control of Behavior, Academic Press.
5. Manning A and Dawkins MS (2012) An Introduction to Animal Behaviour, 6<sup>th</sup> Ed. Cambridge University Press.
6. Drickamer and Vessey (1986) Animal Behaviour – Concepts, Processes and Methods, 2<sup>nd</sup> Ed. Wadsworth.
7. Shukla et al (2011) Economic Zoology, Biostatistics and Animal Behaviour, Rastogi Publication.
8. Mandal FB (2015) Text book of Animal Behaviour, 3<sup>rd</sup> Ed. PHI Learning.

**Percent Change From Previous Syllabus: 50.0 %**

**Course Objective:**

Ethology focuses on behavior under natural conditions, and viewing behavior as an evolutionarily adaptive trait. Understanding how genes and the environment come together to shape animal behavior is also an important underpinning of the field. Genes capture the evolutionary responses of prior populations to selection on behavior.

**Course Outcomes:**

Students will understand the ways how animal interact with other organisms and the physical environment.

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Department of Zoology, GGV, Bilaspur (CG)

SEMESTER III

Major Elective Course E: Toxicology

LZT 303 E: ENVIRONMENTAL AND OCCUPATIONAL TOXICOLOGY

**Unit 1: Introduction to toxicology:** History and scope of toxicology; Different areas of modern toxicology; Classification of toxic substance; Various definitions of toxicological significance.

**Unit 2: Exposure and response to toxicants:** Types and characteristics of exposure; routes and site, dose, duration and frequency; Dose-response relationship; LD50, LC50, TD50 and therapeutic index, Variation in toxic responses; Descriptive animal toxicity tests; Aquatic toxicology; Bioaccumulation and biomagnification.

**Unit 3: Metal toxicity:** Metal-Ligand interactions in biological fluids, metal ion interactions with macromolecules; Metal protein interaction; metal nucleic acid interactions; Induction of metallothionein, heat shock proteins, cytoskeletal effects, hemoeporphyrin metabolism.

**Unit 4: Occupational hazards and related diseases:** Physical hazards, Chemical hazards, Biological hazards, Mechanical hazards, Psychosocial hazards; Pneumoconiosis, silicosis, asbestosis, anthracosis, byssinosis, bagassosis, Farmers' lung; Occupational Cancer: Skin, lung and bladder cancer, leukaemia.

**Unit 5: Prevention of occupational diseases:** Medical measures, Engineering measures, Legislative measures, Occupational health in India.

Books Recommended

1. Klassen CD(2008) Cassarett and Doull's Toxicology: The Basic Science of The Poisons, 7<sup>th</sup> Ed. McGraw Hill Publisher.
2. Timbrell J (2000) Principles of Biochemical Toxicology, 3<sup>rd</sup> Ed. Taylor and Francis Publishers.
3. Karen S and Brown TM (2006) Principles of Toxicology, 2<sup>nd</sup> Ed. CRC press.
4. Lu FC and Kacow S (2009) Lu's Basic Toxicology: Fundamentals target organ and risk assessment, 5<sup>th</sup> Ed. Informa Health care.
5. Hohgson E (2010) A Textbook of Modern Toxicology, 4<sup>th</sup> Ed. John Wiley & Sons.
6. McQueen CA (2018) Compreh. Toxicology-Vol 1: General principle 3<sup>rd</sup> Ed. Elsevier.
7. Manahan SE (2003) Toxicological Chemistry and Biochemistry, 3<sup>rd</sup> Edition, Lewis Publishers, CRC Press Company
8. Stine KE and Brown TM (2006) Principles of Toxicology, 2<sup>nd</sup> Ed. Taylor & Francis.

Percent Change From Previous Syllabus: 50.0 %

Course Objective:

To be acquainted with the history and scope of toxicology, metal toxicity and occupational health hazards so that student may develop reasoning behind the effect of environment.

Course Outcomes:

Student will be able to understand toxicology and its scope in life, to identify different types of toxicants and create understanding about effects of toxic agents present in environment.

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Department of Zoology, GGV, Bilaspur (CG)

SEMESTER IV

**LZT 401: EVOLUTION AND ENVIRONMENTAL BIOLOGY**

**Unit 1: Life's Beginnings:** Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes; An overview of evolutionary thoughts: Lamarckism, Darwinism and Neo Darwinism; Modern synthetic theory; Evolution of horse, Geological time scale, Sources of variations: Heritable variations and its role in evolution, Neutral theory, Molecular clock, Phylogenetic trees, Convergent and divergent evolution.

**Unit 2: Population genetics:** Hardy-Weinberg equilibrium (statement and derivation of equation); Evolutionary forces upsetting H-W equilibrium: Mutation, Natural selection, Genetic Drift mechanism, Role of Migration and Mutation in changing allele frequencies, Isolating mechanisms: Concepts of species and models of speciation, Adaptive radiation/macroevolution (exemplified by Galapagos finches).

**Unit 3: Ecosystem dynamics:** Ecological hierarchy in nature, Biotic and abiotic factors of environment, Ecosystem functioning-concept of trophic level, food chain, food web, ecological pyramids, energy flow in ecosystem, ecological efficiency.

**Unit 4: Population ecology:** Population dynamics, Population growth form, r- and k- selections and carrying capacity, Biological communities and species interactions, Types of interactions between two species, Interspecific competition.

**Unit 5: Human impact on the environment and sustainable development:** Concept of sustainable development, Environmental degradation (habitat destruction, fragmentation, biological invasions) and management, Forest, water and mineral resources, Biodiversity conservation and concept of ecosystem services, Global environmental changes (ozone depletion, acid deposition, greenhouse gas emissions and global warming), Environmental impact assessment.

**Books Recommended**

1. Bergstrom CT and Dujatkin LA (2012) Evolution 1<sup>st</sup> Ed. WW Norton and Co.
2. Freeman S and Herron JC (2016) Evolutionary Analysis. Pearson Education Ltd, India.
3. Futayma DJ (1997) Evolutionary Biology, 3<sup>rd</sup> Ed. Sinauer Associates.
4. Gillespie JH (1998) Population Genetics: a Concise Guide, John Hopkins Univ Press.
5. Hall BK and Hallgrimson B (2008) Stirekberger's Evolution, 4<sup>th</sup> Ed. Jones and Barlett.
6. Page RDM and Holmes EC (1998) Molecular Evolution: A Phylogenetic Approach. Blackwell Sc.
7. Kardong K (2004) An Introduction to Biological Evolution, McGraw Hill.
8. Smith JM (1998) Evolutionary Genetics 2<sup>nd</sup> Ed. Oxford University Press.

**Percent Change From Previous Syllabus: 25.00 %**

**Course Objective:**

To study how evolution progresses and affects population in individual level.

**Course Outcomes:**

Students will develop understanding about how evolution affects natural selection.  
Students will develop understanding about how speciation occurs due to evolution.  
Students will develop understanding about population genetics.





Department of Zoology, GGV, Bilaspur (CG)

SEMESTER III

**Major Elective Course B: Mammalian Reproductive Physiology and Endocrinology**  
**LZI 303 B: NEUROENDOCRINOLOGY AND NON-CLASSICAL HORMONES**

**Unit 1: Neuroendocrinology-Hypophysiotropic hormones:** Localization, secretion and mechanism of action; Chemistry and physiology of releasing and release-inhibiting hormones, regulation of hypothalamic secretion.

**Unit 2: Adenohypophysis:** Regulation of pituitary hormone secretions, hypothalamo-hypophysial axis; Regulation of the release of adenohypophysial hormones; Paracrine/autocrine secretions; Neural control of ACTH, TSH, prolactin and growth hormone.

**Unit 3: Pineal gland:** Phylogeny and peculiarities of pinealocytes, biosynthesis and regulation of melatonin secretion; Melatonin rhythms: daily and seasonal effects; Role of pineal in circadian physiology; Regulation of pineal secretion, melatonin receptors, physiological actions.

**Unit 4: Non-classical hormones:** Growth factors: cellular origin, secretion and functions; Epidermal growth factor family (EGF and TGF $\alpha$ ) Transforming growth factor  $\beta$  family (TGF  $\beta$ , anti-Mullerian hormone, inhibins and activins); Platelet-derived growth factor family, Fibroblast growth factor family, Insulin family (IGF-I and IGF-II), Nerve growth factor family.

**Unit 5: Hematopoietic growth factors:** Erythropoietin, thrombopoietin and colony stimulating factor, Immunoinflammatory hormones (interleukines, TNF- $\alpha$  and TNF- $\beta$ ), Eicosanoids (prostaglandins, thromboxanes and leukotrienes), Leptin.

**Books Recommended**

1. Bolander (2006) Molecular Endocrinology, 3<sup>rd</sup> Ed. Elsevier.
2. DeGroot and Jameson (2006) Endocrinology Vol 1, 5<sup>th</sup> Ed. Elsevier-Saunders.
3. Williams L (2002) Textbook of Endocrinology, 10<sup>th</sup> Ed. Saunders.
4. Norman and Litwack (1997) Hormones, 2<sup>nd</sup> Ed. Academic Press.
5. Henson and Castracane (2003) Leptin and Reproduction, Plenum, Publishers.
6. Norris and Lopez (2011) Vertebrate Endocrinology Vol 5, 5<sup>th</sup> Ed. Academic Press
7. Brooks and Marshall (1995) Essentials of Endocrinology, Blackwell Science
8. Dharmalingam M (2000) A text book of Endocrinology 1<sup>st</sup> Ed.

Percent Change From Previous Syllabus: 20.0 %

**Course Objective:**

Objective is to note about the classification of hormones and chemical signaling mechanisms, hormone synthesis, secretion and transport. Hormone receptors and signal transduction processes interactions between the endocrine, nervous and immune systems.

**Course Outcomes:**

To enhance knowledge about functions of different hormones, reproduction and sexual differentiation, development and growth; maintenance of the internal environment; and regulation of metabolism and nutrient supply.

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Department of Zoology, GGV, Bilaspur (CG)

SEMESTER IV

LZT 402: BIostatISTICS AND DATA ANALYSIS (MOOCS)

OR

LZT 402: BIostatISTICS AND COMPUTER APPLICATIONS

**Unit 1: Handling data:** Collection of data, Sampling design, Classification and tabulation, Graphical representation of data.

**Unit 2: Basic analysis of data:** Measures of central tendency: Mean, Median and Mode; Merits and demerits of central tendency; Measures of dispersion: Range, Mean deviation, Standard deviation, Standard error of mean.

**Unit 3: Significance test:** Variance, Coefficient of variation, Correlation and Regression and their coefficients; Test of significance: Z-Test, Student t- test, Chi-square test; Analysis of Variance (ANOVA).

**Unit 4: Probability:** Elementary idea of probability, Test of significance and calculations: Z-Test, Student t- test, Chi-square test and its significance

**Unit 5: Computer Application:** Basics of computers; MS Excel: Designing and application of formulae use of statistical tools, Preparation of graphs, histograms and charts; MS Word: typing and editing to prepare dissertation; MS power point: insertion of-figures, graphs, charts for dissertation presentation; Preparation of posters for scientific presentations.

**Books Recommended**

1. James L. Bruning, B.L. Kirtz, Computational Handbook of Statistics (4<sup>th</sup> Edition)
2. Helmut Fritz Van Emden (2008) Statistics for Terrified Biologists. Wiley Blackwell (2008)
3. Rebecca W-Bremer, Martina (2009) Statistics at the Bench-A Step-by-Step Handbook for Biologists.
4. Gupta SC (2018) Fundamental of Biostatistics, Himalaya Publishing House.
5. Snedecor GW and WG Cochran (1994) Statistical Methods 8<sup>th</sup> Ed., Iowa State University Press.
6. Dixon WJ and Massey Jr FJ (1951) Introduction to Statistical Analysis, Mc Grow Hill.
7. Sprinthall RC and Fisk ST (1990) Basic Statistical Analysis, Prentice Hall.
8. Prasad SG (2008) Elements of Biostatistics, 3<sup>rd</sup> Ed., Rastogi Publications.

**Course Objective:**

To design data collection plans, analyze and interpret and draw conclusion from those analysis.

**Course Outcomes:**

Students will learn statistical techniques so that they may play a unique role in safeguarding public health and improving lives through quantitative research.

