



List of New Course(s) Introduced

Department : **Zoology**

Program Name: **Pre-Ph.D. course work**

Academic Year : **2019-20**

List of New Courses

Sr. No.	Course Code	Name of the Course
1	LS/ZOO/PPCW 101	Research Methodology and Ethics in Research
2	LS/ZOO/PPCW 101	Analytical and Instrumentation Training
3	LS/ZOO/PPCW 103 (A)	Aquaculture and Fisheries
4.	LS/ZOO/PPCW 103 (B)	Biochemistry and Molecular Biology
5.	LS/ZOO/PPCW 103 (C)	Endocrinology
6.	LS/ZOO/PPCW 103 (D)	Molecular and Genetic Epidemiology
7.	LS/ZOO/PPCW 103 (E)	Neuroscience
8.	LS/ZOO/PPCW 103 (F)	Toxicology
9.	LS/ZOO/PPCW 104	Seminar Presentation

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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 : 2019-20

School : School of Studies of Life Sciences

Department : Zoology

Date and Time : July 06, 2018 - 4:00 PM

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 Pre-Ph.D. course work scheme and syllabi.

The following members were present in the meeting:

1. Prof. Sangeeta Shukla (External Expert Member BoS, Dept. of Zoology., Jiwaji University, Gwalior)
2. Dr. Monika Bhadauria (HOD, Associate Prof., Dept. of Zoology, GGV.-cum Chairman, BOS)
3. Dr. Rohit Seth (Member BoS, Associate Professor, Dept. of Zoology, GGV)
4. Dr. Santosh Singh (Member, Assistant Professor, Dept. of Zoology, GGV)

Following points were discussed during the meeting related to scheme and syllabus of Pre-Ph.D. course work:

1. In session 2019-20, following new courses were introduced.

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Scheme and Syllabus

Session: 2019-2020

SYLLABUS FOR PRE-Ph. D. COURSE WORK (ZOOLOGY)

Department of Zoology
Guru Ghasidas Vishwavidyalaya, Bilaspur, CG

Scheme

SNo	Type of Course	Course code / Title of the Course	No. of credits	Total Marks
1	Compulsory Paper	LS/ ZOO/ PPCW 101 Research Methodology and Ethics in Research	4	100
2	Compulsory Paper	LS/ ZOO/ PPCW 102 Analytical and Instrumentation Training	4	100
3	Elective Paper	LS/ ZOO/ PPCW 103 (A) Aquaculture and Fisheries	4	100
		LS/ ZOO/ PPCW 103 (B) Biochemistry and Molecular Biology	4	100
		LS/ ZOO/ PPCW 103 (C) Endocrinology	4	100
		LS/ ZOO/ PPCW 103 (D) Molecular and Genetic Epidemiology	4	100
		LS/ ZOO/ PPCW 103 (E) Neuroscience	4	100
		LS/ ZOO/ PPCW 103 (F) Toxicology	4	100
4	Compulsory Paper	LS/ ZOO/ PPCW 104 * Seminar/ Presentation	--	100

Note: Seminar presentation.....



LS/ZOO/PPCW 101: RESEARCH METHODOLOGY AND ETHICS IN RESEARCH

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, sample design, characteristics of good sampling procedure, types of data.

Unit 2: Basics of scientific communication

Types of scientific communication, importance of publishing research papers, review, choosing journals, 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. Writing review articles, preparing and delivering of oral and poster presentations; Intellectual Property Rights.

Unit 3: Statistical analysis

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; Variance, Correlation and Regression and their coefficients; Test of significance: Student's t test, Chi-square test and ANOVA.

Unit 4: Computer application

Basics of computers; MS Word: typing the script, inserting tables, figures and graphs to prepare thesis and research papers; MS Excel: designing and application of formulae use of statistical tools, preparation of graphs, histograms and charts; MS power point: insertion of figures, graphs, charts in presentation; Preparation of posters for scientific presentations.

Unit 5: Research ethics involving human participants or laboratory animals

Ethics and biomedical research: General principles on ethical considerations involving human subjects, ethical review procedures, Institutional ethics committee: its organization and functions, general ethical issues. Ethical guidelines for experimental animals: Sources of experimental animals, Laboratory animal husbandry and management, 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 6: Responsible conduct of research and publication ethics

Values of research, Research misconduct and handling misconduct, Responsible authorship and publication, Peer review, Reviewing and reporting research. International Committee for Medical Journal Editors guidelines. Scientific misconduct; Plagiarism, self-plagiarism, Plagiarism detection- Computer-assisted plagiarism detection- Citation based plagiarism detection, avoiding plagiarism.

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, 9th Ed. Wayne W Daniel (2008).
5. Computer fundamentals, Pradip K Singha and Priti Singha (BPB Publication).

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LS/ ZOO/ PPCW I02: ANALYTICAL AND INSTRUMENTATION TRAINING

Unit 1: Centrifugation

Principle, types and applications of Centrifugation, differential and density gradient centrifugation, analytical ultracentrifugation, separation of DNA/RNA using ultracentrifugation technique, determination of molecular weight and Sedimentation coefficient.

Unit 2: Electrophoretic techniques

General principles; support media; Electrophoresis of nucleic acids; Agarose gel electrophoresis, polyacrylamide gel electrophoresis (native and SDS), 2D electrophoresis, Blotting: Southern, western and northern blotting.

Unit 3: Chromatography

Chromatography: principle, types and applications of thin layer, gas, gel filtration, ion exchange, HPLC, FPLC and affinity chromatography.

Unit 4: Spectroscopy

Electromagnetic spectrum, Lambert Beers's Law, Photometry, UV/VIS Spectrophotometry, Atomic absorption spectroscopy, ESR and NMR spectroscopy, Mass spectroscopy (LC-MS, GC-MS), Fluorescent spectroscopy.

Unit 5: Microscopy

Basic principle, constituents and biological applications of Bright-field microscope, Dark-field microscope, Phase contrast microscope, Differential interference contrast microscope, Fluorescence microscope, Confocal microscope, Atomic force microscopy, Transmission and scanning electron microscope.

Unit 6: Molecular biology techniques

Genotyping techniques- Introduction; theory and practice; RFLP; RAPD; southern hybridization; DNA Sequencing, DHPLC, TaqMan assay, Array CGH, microarray; Primer designing, polymerase chain reaction; Thermal cycler, Gradient PCR, quantitative PCR; TaqMan probes, Syber green, primer qualities.

Suggested readings

1. Wilson and Walker: Principles of Biochemical and Molecular Biological Techniques (6th Ed. 2006, Cambridge University Press)
2. Boyer: Modern Experimental Biochemistry and Molecular biology (2nd Ed. 1993, Benjamin/Cumin)
3. Lodish et al: Molecular Cell Biology (2007, Freeman)
4. Freifelder: Physical Biochemistry (2nd Ed. 1982, Freeman)
5. Plummer: An Introduction to Practical Biochemistry (3rd Ed. 1990, Tata-McGraw Hill)

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LS/ ZOO/ PPCW 103 (A): AQUACULTURE AND FISHERIES

Unit 1: Introduction to aquaculture and fishery resources

Basics of aquaculture; Fin and shell fishes; India and world aquaculture-Role, status and importance of aquaculture; Major inland capture fishery resources in India- Lake and Reservoir fisheries; Nursery system in Estuaries and brackish water; Major and minor marine fishery resources in India.

Unit 2: Culture systems

Monoculture; Polyculture; Extensive and intensive culture; Integrated fish farming- Paddy cum fish culture; Fish and prawn culture in fresh water ponds; Fin fish and shell fish culture in brackish water ponds; Ornamental fish culture; Culture and Nutritional value of Rotifers, Artemia, Copepods and Daphnia

Unit 3: Induced breeding and genetic improvement

Factors responsible for induced breeding; Hypophysation; Use of different synthetic and natural hormones, their formulation and mechanism of action; Bundh breeding; Multiple breeding of carps; Hybridization in fishes; Chromosomal manipulation: Androgenesis and Gynogenesis; Polyploidy.

Unit 4: Techniques in aquaculture and fish biotechnology

Recent techniques in Aquaculture, Cryopreservation technique for life feeds, Bio-enrichment technique; Regulation of vitellogenesis in shell and fin fishes; Application of biotechnology in aquaculture and fisheries; Molecular markers used in fisheries and aquaculture.

Unit 5: Aquatic pollution and ecotoxicology

Eutrophication and their impact on aquaculture; Impact of environmental toxicant on fish health; Detoxification; Waster water treatment methods; Aerobic and anaerobic treatment of water; Water recycling and utilization in aquaculture; Prevention and control of aquatic pollution; Waste disposal systems in India.

Unit 6: Topics relevant to their area of research, literature review and analysis for the given research topic

Suggested readings

1. Chakroff: Freshwater Fish Pond Culture and Management (1987, Scientific Publishers)
2. Jhingran: Fish and Fisheries of India (1985, Hindustan Publishing Corporation)
3. Lagler, Bardach, Miller and May Passino: Ichthyology (2003, John Wiley)
4. Gupta and Gupta: General and applied Ichthyology (Fish and Fisheries) S Chand 2006.
5. Kreuzer, R: Fishery products, FAO, Fishing News (Books) Ltd., England. 1974.
6. Evans: The Physiology of Fishes (2006, CRC Press)
7. Gopakumar, Singh and Chitranshi: Fifty Years of Fisheries Research in India (2000), Fisheries Division Indian Council of Agricultural Research)
8. Hall: Ponds and Fish Culture (1994, Agro Botanical Publishers)
9. Huet: Textbook of Fish Culture, Breeding and Cultivation of Fish, Fishing News (1989)

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LS/ ZOO/ PPCW 103 (B): BIOCHEMISTRY AND MOLECULAR BIOLOGY

Unit 1: Bio-molecules and their interaction relevant to biology

Structure and classification of amino acids, structural organization of protein; primary structure; peptide bond, Secondary structure, α -helix, β -pleated sheet and bends, Ramachandran plot, Tertiary structure, Domains and motifs-Quaternary structure, Weak interaction between biomolecules; H-bonding, Vander-Wall's forces, Electrostatic forces, Hydrophobic interaction.

Unit 2: Bioenergetics and metabolism

Laws of thermodynamics and their applications: Concept of free energy. Metabolism: Concept of metabolic pathways; Energy transduction: Glycolysis and oxidation of unsaturated fatty acids.

Unit 3: Enzymes

Nomenclature and classification; Mechanism of enzyme action: Enzyme substrate binding, Binding energy, entropy change; Enzyme kinetics, Lowering of activation energy, Derivation of Michaelis-Menten equation.

Unit 4: Nucleic acids

Structure and types of DNA, Mechanism of DNA replication: DNA polymerases, Origin of replication and formation of primosome, Replication fork and replisome, Termination of replication. Structure of RNA: m-RNA, t-RNA, r-RNA; Mechanism of transcription: RNA polymerases, Processing of hnRNA, Genetic code and mechanism of translation, Post translational modification.

Unit 5: Apoptosis

Process of apoptosis: Induction and biochemical changes, Execution: cytochrome C release, caspase action, Phagocytosis of apoptotic bodies; intrinsic and extrinsic pathways.

Unit 6: Topics relevant to their area of research, literature review and analysis for the given research topic.

Suggested readings:

1. Nelson et al: Lehninger Principles of Biochemistry (6thed, 2008 MacMillan Worth)
2. Voet&Voet: Biochemistry Vol I & II (3rd ed 2004, Wiley)
3. Lewin: Genes X (20012, Jones and Bartlett)
4. Sambrook& Russell: Molecular Cloning (2001, Cold spring Harbor)
5. Asubel et al: Current Protocol in Molecular Biology (1994, Wiley)



LS/ ZOO/ PPCW 103 (C): ENDOCRINOLOGY

Unit 1: Introduction to Endocrinology

Principles of endocrinology, functions of hormones and their regulation, Chemical signaling: Endocrine, Paracrine, Autocrine and Intracrine mechanism; Chemical classification of hormones and their synthesis; neuroendocrine interaction, hormones and the immune system, hormones, growth promotion and malignancy, genes, mutations and endocrine functions.

Unit 2: Neuroendocrinology

The pituitary gland; Anatomical and functional connections of the hypothalamo-pituitary axis; Growth hormone- secretory patterns and control; Actions of growth hormone and insulin like growth factors; The pineal gland and melatonin; The neural lobe of the pituitary gland-AVP and oxytocin.

Unit 3: Peripheral Endocrine Glands

The endocrine pancreas, mechanism of actions of insulin and glucagon; The thyroid gland, iodine intake; Synthesis of thyroid hormones, actions of thyroid hormones, control of thyroid hormone synthesis and secretions; The Adrenal Gland, specificity of the biological effects of the adrenal steroid hormones; Cholesterol and steroid synthesis in the adrenal cortex; The parathyroid gland and vitamin D.

Unit 4: Molecular Endocrinology

Hormone receptors, transduction and regulation; Hormone action at Molecular level: Molecular mediators (GPCR Family, DAG-Calcium Signaling Systems; RTKs, protein kinases and phosphatases in cellular signaling); Steroid Hormone Receptor Families.

Unit 5: Reproductive Endocrinology

Genetic determination of sexual differentiation; Sexual differentiation; Sexual differentiation of the gonads and internal reproductive tracts; Sexual differentiation of the external genitalia; Control of steroid production in the foetal gonads; Control of gonadotropin synthesis and secretion; The gonadotropins-LH and FSH and their actions; Endocrine changes in puberty.

Unit 6: Reproductive Health and Endocrine Techniques

Techniques in endocrinology; Hyper and hypothyroidism, biochemical measurements of thyroid hormone status; Hormonal replacement therapy and selective estrogen receptor modulators; Ovarian failure; The menopause and andropause; Male and female reproductive disorders: azoospermia, oligozoospermia, varicocele, cryptorchidism, tubal factors, premature ovarian failure, polycystic ovarian syndrome, luteal insufficiency, endometriosis; Assisted Reproductive Techniques.

Suggested readings:

1. Hadley: Endocrinology, Prentice Hall (6th Ed. 2007)
2. Bolander: Molecular Endocrinology (3rd Ed. 2006, Elsevier)
3. DeGroot and Jameson: Endocrinology (5th Ed. 2006, Vol 1, Elsevier-Saunders)
4. Larson Williams Textbook of Endocrinology (10th Ed 2002, Saunders Norman and Litwack).
5. Adashi et al: Reproductive Endocrinology, Surgery and Technology (1996, Lippincott-Raven publishers)
6. Knobil and Neill: Encyclopedia of reproduction, Vol. 1-4, Academic Press, 1998.
7. Lamming: Marshall's Physiology of Reproduction (1984, Longman)
8. Paulson et al: Andrology: Male Fertility and Sterility (1986, Academic Press)
9. Yen et al: Reproductive Endocrinology (1999, Saunders)

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LS/ ZOO/ PPCW 103 (D): MOLECULAR AND GENETIC EPIDEMIOLOGY

Unit 1: Human genome

Fundamental genetic elements, Repetitive elements, Mitochondrial genome, Genome variability: single nucleotide polymorphisms, short sequence repeats, Insertion / Deletion polymorphisms and mixed polymorphisms.

Unit 2: Human gene mutation mechanisms and consequences

Neutral variation, DNA polymorphisms, Disease causing mutations, General principles of genotype -phenotype correlation.

Unit 3: Genetics and genomics of human population structure

Evolutionary forces shaping human genetic variation, Global patterns of human population structure, Genetic structure of human populations with in continents & countries, Databases in human & medical genetics

Unit 4: Disease causation and epidemiological hypotheses

Measures of disease frequency: case definitions incidence and prevalence; Measures of association: odds ratio and risk ratios; Study designs: cross-sectional, case-control, cohort studies

Unit 5: Animal and cellular models in genetics and disease

Different model organisms and their suitability for research. Utilization of organ specific cell lines for expression studies. Generation of various disease models and their use, including transgenic mouse models and the use of induced pluripotent stem cells.

Unit 6: Topics relevant to their area of research, literature review and analysis for the given research topic.

Suggested readings

1. Beaglehole R, Bonita R and Kjellstrom T. Basic Epidemiology. 1998, World Health Organization, Geneva.
2. Richard F and David M. 1991, Lecture notes on Epidemiology and Public Health Medicine. 1991, 3rd Ed. Blackwell Scientific Publications.
3. Templeton AR. 2018, Human Population Genetics and Genomics. Academic Press/Elsevier, Oxford. 498 pgs. <https://www.elsevier.com/books/human-population-genetics-and-genomics/templeton/978-0-12-386025-5>
4. Walz K and Young J. 2019, Cellular and Animal Models in Human Genomics Research (Translational and Applied Genomics). Academic Press; 1st Ed.
5. Robert FM and Ian DY. 1995, Emery's Elements of Medical Genetics, 9th Ed. Churchill Livingstone.
6. Lynn BJ, John CC, Michael JB and Raymond LW. 2003, Medical Genetics. 3rd Ed. Mosby.



LS/ ZOO/ PPCW 103 (E): NEUROSCIENCE

Unit 1: Introduction

An introduction to neuroscience: Parts of the brain and systemic regulation.

Unit 2: Early embryonic development

Major events in early embryonic development: Role of nucleus and cytoplasm, cleavage, formation of blastula and gastrula; Embryonic origin of nervous system, early neural morphogenesis in vertebrates and invertebrates.

Unit 3: The Nervous system

Introduction to the structure and function of the nervous system: Cellular components: Neurons; Neuroglia; axons and dendrites as unique structural components of neurons; Action potential: Generation, conduction and properties of the action potential.

Unit 4: Cellular and molecular neurobiology

Synapse: Synaptic transmission, Types of synapses; synaptic function; Principles of chemical synaptic transmission; Principles of synaptic integration; EPSPs and IPSPs; Ion channels, Neural transmission.

Unit 5: Neurotransmitters

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

Unit 6: Biological imperatives

The Hypothalamic regulation of biological rhythm, stress, sleep, temperature, thirst and drinking, hunger and feeding.

Suggested readings

1. Mark F. Baer; Barry W. Connors. Neuroscience: Exploring the brain. 2015
2. Kandel, Schwartz and Jessell. Principles of Neural Science-4th Edn-Eds. McGraw Hill Companies-2000
3. Simmons and David Young. Nerve Cells and Animal Behaviour-2nd Ed-Peter J CUP-2003
4. Stephan M. Stahl: Essential of Psychopharmacology – Neuroscientific Basis and Practical Applications- 2nd Ed. CUP, 2000.
5. Richard F. Thompson: The Brain –A Neuroscience Primer (2nd Ed., W. H. Freeman & Company), 1993.
6. RitaCarter: The Human Brain Book – (Dorling Kindersley), 2009.
7. Squire: Fundamental Neuroscience (3rd Edition), Elsevier, 2008
8. Smith: Elements of Molecular Neurobiology. John Wiley & Sons, Ltd. 2003



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2. Kandel, Schwartz and Jessell. Principles of Neural Science-4th Edn-Eds. McGraw Hill Companies-2000
3. Simmons and David Young. Nerve Cells and Animal Behaviour-2nd Ed-Peter J CUP-2003
4. Stephan M. Stahl: Essential of Psychopharmacology – Neuroscientific Basis and Practical Applications- 2nd Ed. CUP, 2000.
5. Richard F. Thompson: The Brain –A Neuroscience Primer (2nd Ed., W. H. Freeman & Company), 1993.
6. RitaCarter: The Human Brain Book – (Dorling Kindersley), 2009.
7. Squire: Fundamental Neuroscience (3rd Edition), Elsevier, 2008
8. Smith: Elements of Molecular Neurobiology. John Wiley & Sons, Ltd. 2003



LS/ ZOO/ PPCW 103 (F): Toxicology

Unit 1: Introduction

An introduction to toxicology; Classification of toxic substances; Biochemical and molecular methods in toxicology.

Unit 2: Toxicant processing *in vivo*

Routes of exposure to xenobiotics and disposition of xenobiotics in animal body (Absorption, Distribution, Biotransformation and Excretion of xenobiotics); Toxicity of herbal, dietary supplements and certain drugs. Occupational health hazards, diseases and preventive measures.

Unit 3: Reactive metabolites and oxidative stress

Introduction to reactive metabolites; Reactive oxygen species and reactive nitrogen species; Sources of ROS and RNS; Nature of free radicals and their generation; Initiation, propagation and termination of radical reactions; Formation of free radicals in lipids and lipid membranes; Oxidative stress and its toxicological consequences on proteins, lipids and DNA.

Unit 4: Antioxidant defense mechanisms

Role of enzymatic antioxidants including Superoxide dismutases, Catalase, Glutathione peroxidase, Glutathione reductase, and non enzymatic antioxidants, including Glutathione, tocopherols and β -carotene.

Unit 5: Systemic Toxicity

Liver structure and liver function tests, susceptibility of liver and types of liver injury, metabolic activation of hepatotoxicants; Structural organization of the kidney, kidney function tests, factors contributing to nephrotoxicity, nephrotoxicants.

Unit 6: Metals 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, cyto skeletal effects, heme-porphyrin metabolism.

Suggested readings

1. Klassen CD (2008) Cassarett and Doull's Toxicology: The Basic Science of The Poisons, 7th Ed. McGraw Hill Publisher.
2. Timbrell J (2000) Principles of Biochemical Toxicology, 3rd Ed. Taylor and Francis.
3. Klaassen and Whatkins (2010) Cassarett and Doull's "Essentials of Toxicology" 2nd Ed. McGraw Hill Publisher.
4. Karen S and Brown TM (2006) Principles of Toxicology, 2nd Ed. CRC press.
5. Manahan SE (2003) Toxicology, Chemistry and Biochemistry, 3rd Ed. CRC Press LLC
6. Pillay VV (2013) Modern Medical Toxicology 4th Ed. Jaypee Brothers Medical Publishers
7. Hoggson E (2010) A Textbook of Modern Toxicology, 4th Ed. John Wiley and Sons, Inc., Publication.
8. McQueen CA (2018) Comprehensive Toxicology: Vol 1-14, 3rd Ed. Elsevier Publications.

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