DAV UNIVERSITY, JALANDHAR

Scheme of Courses for
Doctor of Philosophy - Zoology

Syllabus for Course Work

Course Syllabus Applicable to Admissions in 2020

Semester 1

S.No.	Paper Code	Course Title	L	T	P	Credits	Course Type
1.	BCH801	Research Methodology in Life Sciences	4	0	0	4	**Core**
2.	ZOO801	Advanced Molecular Techniques	4	0	0	4	**Elective**
3.	ZOO802	Seminar/Workshop/ Thesis Review	0	0	2	2	**Elective**
4.		Specialization course*	4	0	0	4	**Core**
		***Total**	**12**	**0**	**2**	**14**	
Specialization Courses (Choose any one of the following)							
1.	ZOO803	Advances in Parasitology	4	0	0	4	**Elective**
2.	ZOO804	Principles of Toxicology	4	0	0	4	**Elective**
3.	ZOO805	Molecular Genetics	4	0	0	4	**Elective**

L: Lectures T: Tutorial P: Practical Cr: Credits

Course Title: Research Methodology in Life Sciences
Paper Code: BCH801

L	T	P	Credits	Marks
4	0	0	4	100

Objective:
To make the students learn how to design an experiment and what are the various research strategies.

Teaching Methodology:
Class room Lectures, practicals, models, charts, power point presentations.

Learning outcomes:
This course will impart the comprehensive knowledge of designing a research experiment, how to write a research paper, the relevant ethics, copy right, impact factor etc.

UNIT-I

Biostatistics: Definition and relevance in biological research; Measures of Central Tendency:Arithmetic Mean, median, mode, quartiles and percentiles; Measures of Dispersion:Range, variance, standard deviation, coefficient of variation; Skewness and Kurtosis.

Inferential Statistics: Hypothesis testing, Errors in Hypothesis Testing-Null Hypothesis, Alternative Hypothesis, Type I and Type II errors, Confidence Limits. Setting up of level of significance. One tailed and Two-tailed tests.

Correlation and Regression: Correlation coefficient (r), properties, interpretation of r, partial and multiple correlations, linear regression: Fitting of lines of regression, regression coefficient, Bivariate and Multiple Regression.

UNIT-II

Parametric and Non-Parametric Statistics: Definition, Advantages, Disadvantages, Assumptions; Parametric Tests: Student's t-test, One Way Analysis of Variance, Two Way Analysis of Variance; Non-Parametric Tests: Analysis of Variance, Chi square and Kendall Rank Correlation

Experimental Set-up: Basic principles and significance of research design; Randomized Block Designs (RBD), completely randomized designs (CRD); Latin square design and Factorial design

UNIT-III

Data collection, organization and interpretation.

Research articles, research papers, popular research articles and reviews; difference between periodicals; journals; monographs, magazines; proceedings.

How to write a research paper, reference styles, process of submission of a paper; process of proof reading of a research manuscript; process of reviewing.

Important journals in life-sciences.

An introduction to Science citation index; H-index, i10 index, Impact factor calculation, Impact factor of a journal; Eigen factor, Major journal search engines.

Copyright act; Academic frauds; Plagiarism; Softwares to check plagiarism.

UNIT-IV

Biosafety and Bioethics in Research: Guidelines for Biosafety and Bioethics; Safety practices and Bio-waste in the laboratory; Radioactivity and Safety; Fire hazards and safety; Institutional Biosafety, Ethics and Animal Ethics compliance and concerns; Genetically modified organisms; Patents and Intellectual property rights; Reproduction of published material, Citation and acknowledgement; Guidelines for Ph.D. thesis.

Reference Books

1. Kothari, C.R.Research Methodology–Methods and Techniques. 2nd revised ed. New Delhi: New Age International (P) Ltd. Publishers, 2007. Print.
2. McKillup, S. Statistics Explained. An Introductory Guide for Life Scientists. Cambridge, UK: Cambridge University Press, 2006. Print.
3. Selvin, S. Biostatistics–How it Works. First Impression. New Delhi: Pearson Education Inc., 2007. Print.
4. Agarwal, B.L. Basic Statistics. New Delhi: New Age International, 2006. Print.

Course Title: Advanced Molecular Techniques
Paper Code: ZOO801

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To acquaint the students with various instruments used in scientific laboratories and to make them understand the basic principles involved in the important techniques used in scientific research.

Teaching Methodology:

Class room Lectures, practicals, models, charts, power point presentations, activities.

Learning outcomes: After successfully completing this course, the students will be able to:

1. Understand in detail the microscopic techniques used in research laboratory.
2. Understand in detail the immunological techniques used in research laboratory.
3. Understand in detail the molecular techniques used in research laboratory.

UNIT-A 15 hours

- **Microscopy:** Principles of light, phase contrast, fluorescence, confocal, scanning and transmission microscopes; Different fixation and staining techniques for electron microscope (EM); Freeze-etch and freeze-fracture methods for EM, Microphotography and image processing methods in microscopy.
- **Centrifugation:** Different mechanical and chemical procedures for cell fractionation; Principle of centrifugation and ultra-centrifugation; Different methods of ultra-centrifugations (in brief) and their applications; Structural parts of an analytical ultracentrifuge.

UNIT-B 15 hours

- **Molecular biology techniques:** PCR, qPCR, RFLP, RAPD, AFLP, Microsatellite, SNP; DNA sequencing: Maxam-Gilbert sequencing, Sanger sequencing; Introduction to Next-Generation Sequencing (NGS).
- **Electrophoresis:** Principles of electrophoresis, Agarose gel electrophoresis, Capillary electrophoresis, Two-dimensional gel electrophoresis, Polyacrylamide gel electrophoresis (PAGE), SDS-PAGE, Southern blotting, Northern blotting, Isoelectric focussing, Applications of electrophoresis.

UNIT-C 15 hours

- **Immuno-techniques:** Antibody generation, ELISA, RIA, Western blotting, Immunoprecipitation, Flow cytometry and fluorescence, Immunoelectron microscopy, Fluorescent *in situ* hybridization (FISH) and Genome *in situ* hybridization (GISH).
- **Radioisotopes:** Radioactive isotopes, Half-life of isotopes, Detection and measurement of radioactivity (Gas ionization, Scintillation and autoradiography), Applications of radioisotopes in biological sciences, Metabolic labelling, Magnetic Resonance Imaging.

UNIT-D 15 hours

- **Chromatography:** Principles of chromatography, Paper chromatography, Thin layer chromatography, High pressure thin layer chromatography, Gas chromatography, Gel permeation chromatography, Ion exchange chromatography, High pressure liquid chromatography, Affinity chromatography.
- **Spectroscopy:** Ultraviolet and Visible light spectroscopy, Fluorescence spectroscopy, Atomic spectroscopy, Nuclear magnetic resonance, X-ray diffraction.

Reference books:

1. Boyer, R.*Modern Experimental Biochemistry.* 3rd ed. Pearson Education, 2004
2. Freshney, R.I.*Culture of Animal Cells: A manual of basic technique.* 5th ed. New York: Wiley Liss Inc., 2006.
3. Gurumani, N.*Research methodology for Biological Sciences*. MJP Publishers, Chennai, 2007.
4. Kuby, J. *Immunology*. 6th ed., W.H. Freeman and Company, 2007.
5. Wilson, Keith and Walker, John. *Practical Biochemistry: Principles and techniques*, 5th Edition, Cambridge University Press, 2000.

L	T	P	Credits	Marks
4	0	0	4	100

Course Title: Advances in Parasitology
Course Code: Z00803
Objective:

To acquaint the students with various aspects of parasites such as their interactions with hosts, pathogenicity, their adaptations to parasitic mode of life and immune evasion mechanisms.

Teaching Methodology:

Class room Lectures, practicals, models, charts, power point presentations, activities.

Learning outcomes: After successfully completing this course, the students will be able to:

1. Learn the life cycle of parasites.
2. Learn the pathogenicity, diagnosis and treatment of the parasites
3. Understand host-parasite interactions
4. Learn the concept of vaccines and their use against parasitic infections.

Unit A 15 hours

- **Concepts in Parasitology:** Parasitism, types of parasites and hosts
- **Parasitic adaptations:** Morphological, physiological and ecological adaptations
- **Effects of parasite on host:** Pathogenic and physiological effects
- **Host-parasite interactions:** Molecular and cellular basis
- **Parasite transmission:** Various modes of parasite transmission

UNIT B 15 hours

- **Protozoan parasites:** Life-cycle, pathogenesis, treatment and control of *Plasmodium*, *Leishmania*, *Entamoeba* and *Giardia*
- **Trematode parasites:** Life-cycle, pathogenesis, treatment and control of *Fasciolopsis*, *Schistosoma*, *Clonorchis* and *Paragonimus*

UNIT C 15 hours

- **Cestode parasites:** Life-cycle, pathogenesis, treatment and control of *Taenia*, *Echinococcus*, *Hymenolepis* and *Diphyllobothrium*
- **Nematode parasites:** Life-cycle, pathogenesis, treatment and control of *Ascaris*, *Wuchereria*, *Ancylostoma* and *Dracunculus*

UNIT D 15 hours

- **Immunity to parasites:** Innate immunity, acquired immunity, evasion of immune response by parasites
- **Vaccines:** General concept, types of vaccines
- **Immunodiagnostic Techniques:** Immunodiffusion, Immunofluorescence assay (IFA), ELISA, western blotting and Flow cytometry

Reference books

1. Kuby J. *Immunology*. Freeman Publications, 2012.
2. Chatterjee, K. D. *Parasitology: Protozoology and Helminthlogy*. 13th ed. CBSpublishers and distributors Pvt Ltd, 2009.
3. Cheng, T.C. *General Parasitology*. 2nd ed., London: Academic Press, 1986.
4. Garcia, L.S. *Diagnostic Medical Parasitology*. 4th Ed. Washington DC: ASM Press, 2001.
5. Ichchpujani R.L.and Bhatia, R.*Medical Parasitology*. 3rd Ed. New Delhi: Jaypee Brothers Medical Publishers, 2002.
6. Larry S. Roberts & John Janovy Jr., Foundations of Parasitology Mc. Graw Hill Book Co., (2000).
7. Noble, E.R. & Noble, G.A.*Parasitology: The biology of animal parasites.* 5th edition. Philadelphia: Lea & Febiger, 1982.

Course Title: Principles of Toxicology
Course Code: Z00804

L	T	P	Credits	Marks
4	0	0	4	100

Objective: This course is focused on theoretical and applied knowledge on the effects of chemical substances on human health. The students will also get introduced to the toxicological analysis and the signs and symptoms of important toxic syndromes. The students will also study the basic toxicokinetic principles and metabolic systems to elucidate mechanisms of toxicity induced by xenobiotic compounds.

Teaching Methodology:

Class room Lectures, practicals, models, charts, power point presentations, activities.

Learning outcomes: After successfully completing this course, the students will be able to:

1. learn basic principles of signaling pathways and mechanisms of cell death
2. understand gene-environment interactions
3. examine the application how xenobiotics disrupt normal cellular processes of genomics, proteomics, and metabolomics data
4. understand mechanisms of systemic and organ toxicity induced by xenobiotics; and 5) learn how to analyze and interpret complex data sets in toxicological research and deliver a scientific presentation.
5. use clinical and laboratory findings in the treatment of acute toxic exposures

Unit-A 15h

- History of Toxicology.
- Measuring Toxicity and Assessing risk.
- Toxiokinetics : Absorption, distribution and elimination of Toxins.

Unit-B 15h

- Toxicopanomics : Application of Genomics, Proteomics and Metabonomics in Toxicology
- Biotransformation of Toxins: Phase I and Phase II reactions.
- Carcinogenesis

Unit-C 15h

- Reproductive toxicology and Teratology.
- Effects of Toxins on: Respiratory, Cardiovascular, nervous, hepatic, renal and Immune system.

Unit-D 15h

- Ecological Toxicology: Effects of Toxins at population, community and ecosystem level.
- Applications of Toxicology: Forensic Toxicology, Pharmaco Toxicology, Environmental Toxicology.

Books Recommended:

1. Hayes, A. W. (2007). Principle and Methods of Toxicology, CRC Press NY.
2. Newman, M.C. and Clements, W.H. (2008). Ecotoxicology –A Comprehensive Treatment, CRC Press, NY.
3. Stine, K. E. and Brown, T. M. (2006). Principles of Toxicology. CRC Press, NY.
4. Walker, C. H., Hopkin, S.P., Silby, R. M. and Peakall, D. B. (2006). Principles of Ecotoxicology, Informa, CRC Press NY.
5. Wright, D.A. and Welbourn, R. (2002). Environmental Toxicology, Cambridge University Press, UK.

Course Title: Molecular Genetics
Paper Code: ZOO805

L	T	P	Credits	Marks
4	0	0	4	100

Objectives: To understand the underlying theoretical principles of the scientific methods and approaches of molecular genetics and to enable the students to critically interpret experimental designs related to molecular genetics.

Teaching Methodology:

Class room Lectures, practicals, models, charts, power point presentations, activities.

Learning outcomes: After successfully completing this course, the students will be able to:

1. Understand the cooncepts of genome, genepool and genetics
2. Understand the central dogma at molecular level.
3. Understand the applications of genetics and genomics.

Unit-A 15h

Organization of genome: General features of chromosomes, C-value paradox, Repetitive DNA, General concept of a gene, Protein coding genes, Pseudogene, Gene families, Non-coding genes.

Unit-B 15h

Gene mapping: Gene mapping by somatic cell hybridization, Top-down approach to molecular mapping, Restriction maps and contig construction (the bottom-up approach).
Engineering chromosomes: Yeast artificial chromosome, Mammalian artificial chromosome, and satellite DNA's artificial chromosomes.

Unit-C 15h

Gene regulation: Genes controlling replication, Post-transcriptional regulation: Alternative splicing, Transport and targeting of RNA, Post-transcriptional gene silencing, Regulation of gene expression, Translational control and targeting of proteins, Mechanism of steroid hormone and stress induced gene expressions.

Unit-D 15h

Functional genomics: cDNA/gene, cloning; site-directed mutagenesis, methods for generation of transgenic animals/ knock-in, knockout models (microinjection, ES cell transformation); RNAi approach.
Whole genome study: Single nucleotide polymorphism, Copy number variations, Pulse field gel electrophoresis, Automated DNA sequencing, Next-generation sequencing.

Reference books:

1. Atherly *et al.*, *The Science of Genetics*, Saunders, 1999.
2. Dale & Schartz, *From genes to Genome*, Wiley and Sons, 2003.
3. Latchman, *Gene Regulation*, Chapman & Hall, 1995.
4. Griffiths *et al.*, *Modern Genetic Analysis*, Freeman, 2002.
5. Snustad, D.P. and Simmons, M.J, *Principles of Genetics*, John Wiley & Sons, 2011.
6. Benjamin Lewin, *Genes IX*, Jones and Bartlett Publishers, 2008.