

**Central University of Punjab,
Bathinda**



Program: Ph.D. Animal Sciences

Academic Session: 2019 - 20

Department of Animal Sciences

School of Basic and Applied Sciences

Semester - I

Sr. No.	Course Code	Course Title	L	T	P	Cr
1	LAS.701	Research Methodology, Biostatistics and Computer Applications	3	1	-	4
2	LAS.702	Advanced Cell and Molecular Biology	3	1	-	4
3	LAS.703	Advances in Animal Sciences	3	1	-	4
4	LAS.704	Advanced Research Techniques	3	1	-	4
Minimum No. of Credits Required						12

* **Compulsory course; L: Lectures; P: Practical; T: Tutorials; Cr: Credits**

Note: The course work shall be a minimum of **12 credits** (as recommended by the 3rd school board meeting) and can be increased as per the recommendations of the departmental doctoral research committee (DRC) to a maximum of **16 credits** (also as prescribed by the UGC regulations-2016); and the student also has to undertake **80 research credits** (as per CUPB's guidelines) for the award of Ph.D. degree in Animal Sciences.

Semester – I

L	T	P	Cr
3	1	-	4

LAS.701: Research Methodology, Biostatistics and Computer Applications

Learning Outcomes: This course will help students to plan, execute and understand their research and complex outcome of their results using biostatistical approaches in the testing of hypothesis, designing of experiments, analyzing experimental data and interpretation of the results. Further, the course will ensure that the student understands the various aspects of research methods, ethics, technical and scientific writing; and in addition exposed to the use of computer applications during their research.

Unit I

20 Hours

General Principles of Research: Importance of research, critical thinking, hypothesis formulation, research plan development, interpretation of results. **Technical Writing:** Writing a research report - Synopsis, Research paper, Review article, Poster preparation, Oral presentations. **Plagiarism:** Avoiding Plagiarism during documents / thesis / manuscripts / scientific writing. **Bibliographic index and research quality parameters:** citation index, impact factor, *h*-index, i10 index, etc. **Research engines:** Google scholar, Scopus, Web of science, etc. Intellectual property protection (IPP) and Intellectual property rights (IPR).

Unit II

15 Hours

Good Laboratory Practices: Introduction and principles, Physical, Chemical & Biological hazards; Center for Disease Control, Biosafety levels; Radioactive, biohazard and laboratory waste management. **Research Ethics: History and Fundamentals;** Ethical theories; Bioethics; Data manipulations; Animal testing and ethics.

Unit III

15 Hours

Computer Applications in Research: Organization, management and analysis of biological data, biological databases – DNA, RNA and protein sequence databases, BLAST, FASTA, multiple sequence alignment, primers in biology (design and types of primers), NCBI, PubMed, UCSC and other useful databases, *In silico* approaches for drug design.

Unit IV

10 Hours

Biostatistics: *P*-value, ANOVA analysis, various statistical tests, Computer application to statistical packages (Graphpad prism, SPSS etc.), use of computers in data analysis: MS excel and Sigma plot analysis.

Suggested Reading:

1. Gupta, S. (2008). Research Methodology and statistical techniques. Deep & Deep Publications (P) Limited, New Delhi.
2. Kothari, C. R. (2014). Research methodology (s). New Age International (p) Limited. New Delhi.
3. Sahay, Vinaya and Singh, P. (2009). Encyclopedia of Research Methodology in life sciences. Anmol Publications. New Delhi.
4. Kauda J. (2012). Research Methodology: A Project Guide for University Students. Samfunds literature Publications.
5. Dharmapalan B. (2012). Scientific Research Methodology. Narosa Publishing
6. Norman, G. and Streiner, D. (2008). Biostatistics: The Bare Essentials.3/e (with SPSS). Decker Inc. USA.
7. Rao, P. P., S. Sundar and Richard, J. (2009). Introduction to Biostatistics and Research Methods. PHI learning.
8. Christensen, L. (2007). Experimental Methodology. Boston: Allyn & Bacon.
9. Fleming, D. O. and Hunt, D.L. (2006). Biological Safety: Principles and Practices. American Society for Microbiology, USA.
10. Rockman, H. B. (2004). Intellectual Property Law for Engineers and Scientists.
11. Wiley-IEEE Press, USA.
12. Shannon, T. A. (2009). An Introduction to Bioethics. Paulist Press, USA.
13. Vaughn, L. (2009). Bioethics: Principles, Issues, and Cases. Oxford University Press, UK.

Elective Courses (Opt any two):

L	T	P	Cr
3	1	-	4

LAS.702: Advanced Cell and Molecular Biology

Learning Outcomes: The main objective of this course is to prepare students for current research-oriented and advanced aspects of cell and molecule biology. The students undergoing this course will be provided with latest scientific breakthroughs and current research developments via research and review articles and other online resources.

Unit I**30 Hours**

Advanced concepts in cell biology: The molecular basis of cell cycle regulation; cell-matrix interactions: integrins and other ECM adhesion molecules; ECM and its role in wound healing; cell signaling and functions controlled by kinases and phosphatases; cell migration and its control mechanisms; cell-cell and epithelial-mesenchymal interactions; cell death mechanisms; biology of stem cells and stem cell therapies.

Unit II**30 Hours**

Advanced concepts in molecular biology: Chromatin remodeling and nucleosome modifications, alternative DNA structures: role in DNA damage, repair, and genetic instability; human genome project; epigenetic regulation and role in health and disease; genome editing: CRISPR-CAS technology; types of RNAs and non-coding RNAs; regulation of gene expression by non-coding RNA in various diseases; DNA and RNA binding proteins.

Suggested Reading:

1. Barciszewski, J. (2003) Non-Coding RNAs: Molecular Biology and Molecular Medicine, Springer Publisher.
2. Slaby, O. (2012) MicroRNAs in Solid Cancer: From Biomarkers to Therapeutic Targets (DNA and RNA: Properties and Modifications, Functions and Interactions, Recommendations and Applications), Nova Science Publishers.
3. Pecorino, L. (2012) Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics, Oxford Edition.
4. Alberts, B. (2008) Molecular Biology of the Cell, Garland Science
5. Cantley, L. C., Hunter, T., Sever, R. (2014) Signal Transduction: Principles, Pathways and Processes, Cold Spring Harbor Laboratory Press.

LAS.703: Advances in Animal Sciences

L	T	P	Cr
3	1	-	4

Learning Outcomes: This course will help students to learn about various animal models used for various diseases. The students would also be able to know various pathways relevant to human and animal systems.

Unit I**20 Hours**

Animal models of disease and research: Hydra as a model for regeneration and morphogenesis; *Drosophila* & *C. elegans* as models of genetics, development, drug discovery and neurobiology, Mosquito as model of disease transmission, Zebrafish as apoptotic and drug assessment model, Murine models (Knock-in, knock-out, knock-down, nude and SCID mice).

Unit II**20 Hours**

Animal Transgenics & Vaccines: Transgenic animals (Transgenic mice, Transgenic livestock, Transgenic poultry); vaccines (subunit-, peptide-, attenuated-, DNA- and vector-based).

Unit III**20 Hours**

Cell Signaling and Human Health: Cancer associated signaling pathways; Akt Signaling, MAP kinase signaling, PARP, apoptosis, p53 signaling, caspase

signaling, NF-kB signaling, JAK, STAT3 pathways, PTEN, mTOR signaling pathway, Wnt signaling pathway, VEGF signaling pathway, Toll-like receptor signaling pathway; Clinical trials & therapeutics.

Suggested Reading:

1. Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard J. Glick, Jack J. Pasternak, Cheryl L. Patten, 4th edition
2. Principles of Gene Manipulation by Sandy B. Primrose, Richard Twyman, Bob Old Seventh edition
3. An introduction to genetic engineering, Third edition by Dr. Desmond S.T. Nicholl
4. Molecular cloning by R. Green and Joseph Sambrook, 4th Edition, CSHL Press
5. Essentials of Stem Cell Biology, Third Edition, Robert Lanza & Anthony Atala, Academic Press.

L	T	P	Cr
3	1	-	4

LAS.704: Advanced Research Techniques

Learning Outcomes: The aim of this advanced course is to acquaint the students with the advanced and versatile tools and techniques employed in life sciences. A sound knowledge on methodological repertoire will allow the students to innovatively apply these in basic and applied fields of biological research.

Unit I

22 Hours

Genomics: Chromatin-immunoprecipitation, DNA footprinting, EMSA: gel-shifts assay, Southern blotting, Northern blotting, whole genome sequencing, microarray technology, DNA & RNA sequencing methods, FISH technique.

Unit II

22 Hours

Proteomics: Gel electrophoresis techniques (2-dimensional, tricine and pulse-field), mass spectrometric analysis, immunoblotting and detection methods, yeast two hybrid system, polyclonal antibody production, approaches to posttranslational modification analysis, *in situ* and gel zymography

Unit III

16 Hours

High-resolution imaging techniques: Confocal laser scanning microscopy (CLSM), Z-stacking, time lapse microscopy, intravital microscopy, scanning and transmission electron microscopy, flow cytometry, live cell imaging, cryotomy.

Suggested Reading:

1. Brown, T. A. (2010). Gene Cloning and DNA Analysis: An Introduction. 6th Edition, Wiley-Blackwell Publisher, New York.
2. Goldsby, R. A., Kindt, T.J. and Osborne, B.A. (2008). Kuby Immunology. 6th Edition, W. H. Freeman & Company, San Francisco.
3. Gupta, P. K. (2005). Elements of Biotechnology. Rastogi Publications, Meerut.
4. Nelson, D. and Cox, M. M. (2009). Lehninger Principles of Biochemistry. W.H. Freeman and Company, New York.
5. Primrose. S. B. and Twyman, R. (2006). Principles of Gene Manipulation and Genomics. Blackwell Publishing Professional, U.K.
6. Sambrook, J. (2006). The Condensed Protocols from Molecular Cloning: A Laboratory Manual. Cshl Press. New York.
7. Sambrook, J. and Russell, D.W. (2000). Molecular Cloning: A Laboratory Manual (3 Vol-set). 3rd Edition, CSHL Press, New York.
8. Sawhney, S.K. and Singh, R. (2005). Introductory Practical Biochemistry. Narosa Publishing House, New Delhi.
9. Wilson, K. and Walker, J. (2006). Principles and Techniques of Biochemistry and Molecular biology. 6th Edition, Cambridge University Press India Pvt. Ltd., New Delhi.