

Central University of Punjab, Bathinda



Ph.D. Zoology

Academic Session: 2020

Department of Zoology

School of Basic and Applied Sciences

Program outcome

The students will be able to provide leadership personality in research and will be employable candidates for academia and industry. They will have innovative ideas and training to initiate start-ups in the field of interdisciplinary science.

IQAC

Sr. No.	Course Code	Course Title	L	T	P	Cr
Core Course*						
1	LAS.701	Research Methodology, Biostatistics and Computer Applications	3	1	0	4
2	LAS.751	Research and Publication Ethics (RPE)	2	0	0	2
Elective Courses (Opt any two)						
3	ZOL.702	Advanced Cell and Molecular Biology	2	1	0	3
4	ZOL.703	Advances in Animal Sciences	2	1	0	3
5	ZOL.704	Advanced Research Techniques	2	1	0	3
Minimum No. of Credits Required						12

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

ZOL.701: Research Methodology, Biostatistics and Computer Applications

L	T	P	Cr
3	1	0	4

Learning Outcomes: After going through the course the learners will be able to

- Train the students for efficient execution of their research
- Illustrate and analyze complex outcome of their results using biostatistical approaches in interpretation experimental data
- Hands-on training to the use of computer applications during their research.

Unit	Syllabus	Lectures
1.	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, <i>h</i> - index, i10 index, etc. Research engines: Google scholar, Scopus, Web of science, etc. Intellectual property protection (IPP) and Intellectual property rights (IPR).	20
2.	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.	15
3.	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, <i>In silico</i> approaches for drug design.	15
4.	Biostatistics: <i>P</i> -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.	10

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.

L	T	P	Credits
2		-	2

ZOL.751: Research and Publication Ethics (RPE)

Learning Outcomes: After going through the course the learners will be able to

- Define and demonstrate publication ethics and fair research practices.

Overview: This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hand-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, *h*-index, impact factor, etc.) and plagiarism tools will be introduced in this course.

Unit	Syllabus	Lectures
1.	PHILOSOPHY AND ETHICS (3hr) Introduction to philosophy: definition, nature and scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgements and reactions	6
2.	SCIENTIFIC CONDUCT (5hr)	6

	Ethics with respect to Science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, fabrication and plagiarism (FFP), Redundant publications: duplicate & overlapping publication, salami slicing, Selective reporting and misrepresentation of data	
3.	<p>PUBLICATION ETHICS (7hr)</p> <p>Publication Ethics: Definition, Introduction and Importance; Best practices/Standards settings initiatives & guidelines: COPE, WAVE, etc. Conflict of Interest, Publication misconduct: definition, concept, Problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics authorship and contributor ship, Identification of publication misconduct, complaints and appeals. Predatory publishers and journals</p>	6
4.	<p>PRACTICE SESSION</p> <p>P-I: OPEN ACCESS PUBLISHING (4 hr) Open access publication and initiatives SHERPA/RoMEO online resource to check publisher copy right and self- arching policies Software tool to identify predatory publication developed by SPPU Journal finder /journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester, etc.</p> <p>P-II: PUBLICATION MISCONDUCT (4hr) <u>Group Discussion (2 hr)</u> Subject specific ethical issues, FFP, authorship Conflicts of interest Complaints and appeals : examples and fraud from India and abroad <u>Software tools (2 hr)</u> Use of plagiarism software like Turnitin, Urkund and other open source software tools</p> <p>P-III: DATABASES AND RESEARCH METRICS (7 hr) <u>Databases (4 hr)</u> Indexing databases Citation databases: Web of sciences, Scopus, etc. <u>Research metrics (3 hr)</u> Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score Metrics: h-index, g-index, i10 index, altmetrics</p>	12

Elective Courses (Opt any two):

ZOL.702: Advanced Cell and Molecular Biology

L	T	P	Credits
2	1	-	3

Learning Outcomes: After going through the course the learners will be able to

- Define and demonstrate advanced aspects of cell and molecule biology.
- Illustrate latest scientific breakthroughs and current research developments via research

Unit	Syllabus	Lectures
1.	Advance Cell biology (I): Membrane transport, Cytoskeleton, Cell cycle regulation, cell to cell junction and cell-matrix interactions, integrins and other cell adhesion molecules, extracellular matrix and its role in wound healing	11
2.	Advance Cell biology (II): Cell signaling, Inter- and Intra-cellular signaling, kinases and phosphatases, cell migration and its control mechanisms, cell death mechanisms, biology of stem cells and stem cell therapies.	12
3.	Advance Molecular biology (I): Chromatin remodeling and nucleosome modifications, alternative DNA structures: role in DNA damage, repair, and genetic instability; human genome project;	11
4	Advance Molecular biology (II): 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.	11

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.

L	T	P	Credits
2	1	-	3

ZOL.703: Advances in Animal Sciences

Learning Outcomes: After going through the course the learners will be able to

- Learn research usage and handling of animal models.
- Illustrate signalling pathways relevant to human and animal systems.

Unit	Syllabus	Lectures
1.	Animal models of disease and research (I): Hydra as a model for regeneration and morphogenesis; <i>Drosophila</i> & <i>C. elegans</i> as models of genetics, development, drug discovery and neurobiology, Mosquito as model of disease transmission.	8
2.	Animal models of disease and research (II) Zebrafish as apoptotic and drug assessment model, Murine models (Knock-in, knock-out, knock-down, nude and SCID mice).	7
3.	Animal Transgenics & Vaccines: Transgenic animals (Transgenic mice, Transgenic livestock, Transgenic poultry); vaccines (subunit-, peptide-, attenuated-, DNA- and vector-based).	15
4.	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.	15

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.

ZOL.704: Advanced Research Techniques

L	T	P	Credits
2	1	-	3

Learning Outcomes: After going through the course the learners will be able to

- Illustrate advanced and versatile tools and techniques employed in life sciences.

Unit	Syllabus	Lectures
1.	Genomics: Chromatin-immunoprecipitation, DNA footprinting, EMSA: gel-shifts assay, Southern blotting, Northern blotting, whole genome sequencing, microarray technology, DNA & RNA sequencing methods, FISH technique.	15
2.	Proteomics (I): Gel electrophoresis techniques (2-dimensional, tricine and pulse-field), mass spectrometric analysis, immunoblotting and detection methods	8
3.	Proteomics (II): Polyclonal antibody production, approaches to posttranslational modification analysis, <i>in situ</i> and gel zymography	7
4.	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.	15

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.

Examination Pattern

End-Term Exam (Final): Based on long descriptive type (10 questions) test (100 Marks)

The course work shall be a minimum of 12 credits (as recommended by the 3rd school board meeting). A student may opt any relevant Ph.D. course(s) being offered across the Life Sciences as per the requirement and 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 Zoology.

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