DEPARTMENT OF ZOOLOGY

DOCTOR OF PHILOSOPHY

ZOOLOGY

SYLLABUS SCHEME
2020 (Onward)

SRI SAI UNIVERSITY, PALAMPUR (H.P.)

Proposed Course Structure

Course Structure

Ph.D. Zoology

Sr. No.	Course /Paper Code	Title of Paper/ Course	Teaching Scheme			No. of Credits	Marks			Total Marks
			L	T	P		Theory	Practical	Internal Assessment	
Semester-I Compulsory Courses										
1	ZOO 611	RESEARCH METHODOLOGY	4	0	0	4	60	0	40	100
2	ZOO 612	RECENT ADVANCES IN ZOOLOGY	4	0	0	4	60	0	40	100
3	RPE-021	RESEARCH AND PUBLICATION ETHICS	1	2	0	2	30	0	20	50
Elective Courses (Student have to choose any one from the following subject related to their Thesis work)										
4	ZOO 601	ECOLOGY	4	0	0	4	60	0	40	100
5	ZOO 602	ENTOMOLOGY	4	0	0	4	60	0	40	100
6	ZOO 603	CELL BIOLOGY	4	0	0	4	60	0	40	100
Semester-II-VI										
7		Thesis/Dissertation work	0	0	4	4*	0	0	0	0
	Thesis work with assessment after every six months						Satisfactory		Unsatisfactory	
*If student does satisfactory performance in Thesis/dissertation work, then He/ She will be awarded 4 credit in respective semester, if not then zero credit will be awarded in respective semester.										

Note: The candidates qualifying the entrance test or those who are exempted from entrance test will have to pass course work before starting their research work. However, they will have to choose supervisor from University for their research. The duration of course work will be one semester and the subjects to be studied shall be decided by the student's supervisor after assessment of his/her already studied courses.

*A Ph. D. Scholar will be allowed to undertake creditable research after the completion of course work.

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COMPULSORY COURSES

PAPER-1: ZOO 611: RESEARCH METHODOLOGY (4+0)

UNIT I

1. Scope: Identification and Selection of Research Problem.
2. Methods of literature collection: online, Internet and Website, Technical papers, Reviews, Monographs and Abstract services.
3. Experimental approach
4. Designing of Methodology: Planning and Execution of Investigations, Methods of Editing and Abstracting, Preparation of Manuscript and Proof Reading – Research ethics- plagiarism- Thesis Writing.

UNIT II

5. Preparation and presentation of research papers for Journals.
6. Refereed journals, Symposia and Conferences, Impact factor, H-index, Citation index.
7. IPR, Patents, Copyright
8. Preparation of research proposals - Funding agencies: TNSCST, UGC, DST, DBT, ICMR, CSIR.

UNIT III

9. Microscopy: Phase contrast microscope, Fluorescence microscope Electron Microscopy: SEM, TEM, STM and ESTM – Principles and applications.
10. Chromatography: Principles and Applications - TLC, CG, GLC, HPLC and GCMS.
11. Electrophoresis: Principles and Applications – Agarose Gel, SDS-PAGE,
12. Immuno-electrophoresis – Southern, Northern and Western Blotting.

UNIT IV

13. Tracer techniques: Radiation measuring devices – Geiger Muller Counter-Scintillation Counter.
14. Autoradiography - Principles and Applications.
15. Spectroscopy: UV-Vis – ESR – NMR. Principles and applications.

UNIT V

16. Mean, Median, Mode and Standard Deviation.
17. Analysis of variance, Correlation and regression.
18. Statistical methods and application: Test of Significance.
19. ANNOVA analysis. Analysis SPSS Package-Statistical analysis using EXCEL.

Suggested Reading:

1. Anderson, Durston, Polle (1970). Thesis and Assignment Writing, Wiley Easter Limited.
2. Allen, H. Benton, William, E. Verner, Jr. (1974). Field Biology and Ecology, McGraw Hill Book Co., New York.
3. King, B. (1986). Cell Biology. London, Allen and Unwin Boston, London.
4. Kumar, H.D. (1998). Modern concepts of Biotechnology. Vikas Publishing House Pvt. Ltd., New Delhi.
5. Ramakrishnan. S., Swamy, R. (1995). Text book of clinical (Medical) Biochemistry and Immunology, TR. Publications, Chennai.
6. N. Gurumani (2006). Research Methodology: For Biological Sciences, MJP Publishers.

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PAPER-II: ZOO 612: RECENT ADVANCES IN ZOOLOGY (4+0)

UNIT I

1. Bioremediation: Bio-Indicators and Molecular markers.
2. Biodiversity: Types and conservation, *IN SITU, EX SITU*, Alpha and Beta - Measures of diversity, Biodiversity conservation laws –
3. Remote sensing and GIS
4. Biofertilizers: Composting, Biopesticides.

UNIT II

5. DNA sequencing - Human genome project – DNA finger printing and foot printing, DNA Bar coding
6. PCR – Types – Genomic Library – DNA recombinant technology – Cloning Vectors – Enzymes – Screening and applications.
7. Animal cell culture: Primary and established cell line, Stem cell therapy.
8. Cloning technique and its application, Ethical issues.

UNIT III

9. Somatic mutation and oncogenes – Induction of mutation by mutagens, Teratogens.
10. Carcinogens – Production of recombinant protein, insulin and growth hormone.
11. Protein Engineering – Enzyme Technology, Transcriptomics, Metabolomics
12. Transgenic animals and their uses.

UNIT IV

13. Organization and expression of immunoglobulin gene
14. Production and Types of Vaccines
15. Development of AIDS and malaria vaccines
16. Immunoflouresence, ELISA, RIA, Karyotyping - FISH – RFLP – HLA

UNIT V

17. Bioinformatics: Generalized and specialized data bases with examples – BLAST
18. Molecular divergence and Phylogenetic trees.
19. Nanobiology: Scope - Characteristics of nanoparticles.
20. Nanosensors – Applications.

Suggested Reading:

1. Abbas, A.K., Lichtman, A.K., Pober, J.S. (1998). Cellular and Molecular Immunology. 3rd Edition, W.B.Saunders Company, U.S.A.
2. Benjamin Lewin (1999). Genes VII. Oxford University Press, New York.
3. Branden, C., Tooze, J. (1999). Introduction to protein structure. II Edition, Garland Publishing, Inc., New York.
4. Desmond, S.T., Nicholl. (1994). An introduction to genetic engineering Cambridge University Press, New York.
5. HAWKINS, J.D. (1996). Gene structure and expression. III Edition. Cambridge University Press, New York.
6. Robert, W. Kelsall, Ian W. Hamley and Mark Geoghegan (2005). Nanoscale Science and Technology, John Wiley & Sons, Ltd., UK,

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PAPER-III: RPE-021: RESEARCH AND PUBLICATIONNETHICS (1+2+0)

RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgements and reactions

RPE 02: SCIENTIFICCONDUCT (5hrs.)

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

RPE 03: PUBLICATION ETHICS (7 hrs.)

1. Publication ethics: definition, introduction and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

RPE 04: OPEN ACCESS PUBLISHING(4 hrs.)

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

RPE 05: PUBLICATION MISCONDUCT (4hrs.)

A. Group Discussions (2 hrs.)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

B. Software tools (2 hrs.)

Use of plagiarism software like Turnitin, Urkund and other open source software tools

RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)

A. Databases (4 hrs.)

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics (3 hrs.)

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g index, i10 index, altmetrics

References

Bird, A. (2006). *Philosophy of Science*. Routledge.
MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.
P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865
National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*. National Academies Press.
Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Sciences*, 1–10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179–179. https://doi.org/10.1038/489179a
Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019), ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf

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ELECTIVE COURSES

(PAPER – IV)

A candidate admitted to Ph. D. programme on the basis of entrance test will have to pass one of these elective courses (as per his/her specialization and recommendation of Ph. D. guide)

ZOO 601: ECOLOGY (4+0)

UNIT-I

1. Concepts and Scope Ecology.
2. The earth systems and Biosphere: lithosphere, hydrosphere, atmosphere and biosphere.
3. Climatic and Topographic factors of Environment.
4. Edaphic factors of Environment. Chemical factors of environment.

UNIT-II

5. Thermal properties of water and survival limits.
6. Ecophysiological adaptations with special reference to desert.
7. Ecophysiological adaptations with special reference aquatic environment.
8. Hibernation and aestivations. Poikilo-therms and Homeotherms.. Acclimatization.

UNIT-III

9. Ecosystem ecology: Components and Functions.
10. Habitat ecology: Fresh water habitat.
11. Habitat ecology: Marine and Estuarine habitat.
12. Habitat ecology: Terrestrial habitat.

UNIT IV

13. Basic concept of Limiting factors.
14. Ecosystem Functions: Productivity, Food Chain, Food web Trophic level and Ecological pyramids.
15. Ecological modeling: Fundamentals of constructing models.
16. Species Interaction: Positive and Negative interaction.

UNIT-V

17. Taiga: Extent and ecological peculiarities.
18. Tundra: Extent and ecological peculiarities.
19. Major biogeographic (zoogeographic and phytogeographic) regions of the world and India, extent, characteristics and species composition.
20. Development and evolution of ecosystems, causes and kinds of succession and productivity in relation to stages of succession and development.

Suggested Reading:

1. Chapman, J.L.& M.J. Reiss. *Ecology Principles and Applications.* Cambridge Univ.Press.
2. Kohli, R.K., N. Jerath&Dazy Rani (Eds.). *Some Facets of Biodiversity*. SES Pub.& PSCST Publication
3. Kumar, H.D. *Modern Concepts of Ecology*. Vikas Publ. House, New Delhi. 293 pp.1996.
4. Odum, F.P. *Fundamentals of Ecology.* 3rd Ed. W.B. Saunders & Co. Philadephia, U.S.A.

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ZOO 602: ENTOMOLOGY (4+0)

1. Introduction and history and scope of Entomology.
2. Fossil insects, origin and evolution of insects.
3. Insect diversity and their outline classification.
4. Insect collection: Significance, Insect nets and traps.

UNIT-II

5. Morphology: external features and their articulation.
6. Comparative study of head-antennae, mouth parts; thorax – legs, wings; abdominal appendages, genitalia.
7. Definition of pest; Types of pest; General idea of damage caused by pests;
8. Principal methods of pest control: Physical, Mechanical, Cultural, Use of Botanicals, Biological and Legal.

UNIT-III

9. The concept of IPM; A general idea of plant protection organization in India.
10. Chemical control: Insecticides: their chief types, modes of action and methods of application/ formulation; a general idea of appliances used in the application of insecticides and their safe handling.
11. A general knowledge of chemosterilants, attractants, repellants, pheromones, growth regulators and other compounds.
12. Life history, damage caused and control of stored grain pests of cereals and pulses (including general idea of storage).

UNIT-IV

13. Parasites of veterinary Importance.
14. Life history, damage caused and control of 3 major pests of the main crops: wheat, paddy, maize, jowar, millet, sugarcane, cotton and oil seeds
15. Insect borne diseases of man – Typhus, yellow fever, dengue fever, encephalitis, plague, leishmaniasis.
16. Insects as vectors of diseases and their control– mosquitoes, house flies, sand flies, lice, fleas.

UNIT-V

17. Dose-response relationship; mode of action of insecticide.
18. Apiculture: Life cycle of Honey bee and Disease.
19. Sericulture: Life cycle of silk worm and Disease.
20. Lac culture: Life cycle of lac insect and Disease.

Suggested Reading:

1. The Insect: Structure and function by R.F. Chapman Insect Physiology by Wigglesworth.
2. Applied Agricultural Entomology by Dr. Lalit Kumar Jha
3. Snodgrass, R.E. Principles of Insect Morphology. Tata MacGrawHill,s Bombay.
4. Nayar, K.K., T.N. Ananthakrishnan and B.V. David. General and Applied Entomology. Tata Mac Graw Hill, New Delhi

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ZOO 603: CELL BIOLOGY (4+0)

UNIT-I

1. Behavior of cell in culture.
2. Primary and established cell lines; kinetics of cell growth
3. Natural and defined media for culture
4. Importance of cell and tissue culture

UNIT-II

5. Freeze substitution, Freeze drying
6. Fresh and fixed frozen sections
7. PAS, Metachromasia, Feulgen, lipid and protein staining techniques
8. Intra-vital and supra-vital staining

UNIT-III

9. Chromatography: Single, two dimensional and column chromatography.
10. Paper, gel and disc electrophoresis
11. Microscopy: Phase contrast microscopy, Polarizing microscopy, Electron microscopy.
12. Working and application of Colorimeter & spectrophotometer.

UNIT-IV

13. Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity.
14. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions.
15. MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation.
16. Hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immune deficiencies, vaccines.

UNIT-V

17. A general account of the effect of ionizing radiation at the cellular level
18. Elementary ideas of the origin of following diseases:
    (a) Glycogen storage disease (b) AIDS
19. Cellular aspects of the process of ageing
20. Cellular aspects of immunity and virus-cell interaction

Suggested Reading:

1. Gerald Karp: Cell and Molecular Biology. Sixth edition. John wiley and sons, inc.
2. Geoffrey M. Cooper and Robert E. Hausman: The cell, A molecular Approach. Fourth edition. ASM Press.
3. Harvey Lodish, Arnold Berk ,Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky and James Darnell: Molecular cell biology.5th edition.
4. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter: Molecular biology of cell. 4th edition. Garland Science, New York.
5. Cooper GM: The cell: Amolecular approach. 2nd Edition. Sunderland (MA): Sinauer Associates.
6. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell: Molecular cell biology.4th edition. New York: W. H. Freeman.

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