मौलाना आज़ाद नेशनल उर्दू यूनिवर्सिटी مولانا آزاد نیشنل اُردو یونیورسٹی
MAULANA AZAD NATIONAL URDU UNIVERSITY
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School of Sciences (Zoology)

Ph.D. Zoology, (Course Work) Syllabus, 2022

Paper-I (CORE COURSE -I) RESEARCH METHODOLOGY

Paper Code:	**PHZY101CCT**	Semester Exam:	**70 Marks**
Instruction:	**4 h / week**	Duration:	**3 hours**
Credits:	**4**	Internal Assessment:	**30 Marks**

Unit I: Scientific Literature Writing & Presentation Skills:

1.1. Researching a scientific problem; defining aims & objectives, hypothesis generation, validation and interpretation of data.

1.2. Basic and applied research problems, translational approach.

1.3. Reading and critical analysis of scientific literature

1.4. Communicating research results in peer-reviewed journals.

1.5.Acknowledgement of contributions, authorship issues; IPR, Scientific ethics, plagiarism.

1.6. Communication skills (Poster and oral)

1.7. Review on a relevant research topic and presentation of the same in a seminar.

Unit II: Experimental Research Design:

2.1. Philosophy of Rene Descartes Measurement; sensitivity, accuracy, precision and specificity.

2.2. The limits and range of measurement in different systems.

2.3. Experimental design; single and double blind studies, placebo

2.4. Maintenance and storage of data, Concept of sampling, Cloud computing

2.5. Positive and negative controls, biological and technical replicates

Unit III: Animal Experimentation:

3.1 Animal handling and ethics

3.2. Maintenance of animals

3.3. Various routes of injections and sample collection

3.4. CPCSEA guidelines; Institutional ethics committees

3.5. Ethical consideration in research on human beings

Unit IV: Laboratory Practices:

4.1. Good laboratory practice; Safety and bio- and radio-hazards, disposal of biological and chemical wastes

4.2. Accuracy of liquid transfer

4.3. Preparation of Reagents, chemicals, buffers

4.4. General safety and precautions

4.5. Handling of Instruments in the CIF

Text Books and References:

1. A Hand Book of Methodology of Research, Rajammall, P. Devadoss and K. Kulandaivel, RMM Vidyalaya press, 1976.
2. Research Methodology Methods & Techniques, C.R. Kothari – New Age international Publishers, Reprint 2008.
3. Thesis and Assignment Writing, J. Anderson, Wiley Eastern Ltd., 1997.
4. Research Methodology, Mukul Gupta, Deepa Gupta – PHI Learning Private Ltd., New Delhi, 2011.
5. Fundamentals of Mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons, New Delhi,1999.
6. Statistical Methods , G.W. Snedecor and W.G. Cochrans, Lowa state University Press,1967.

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Paper-II (CORE COURSE -II)

TOOLS & TECHNIQUES IN RESEARCH

Paper Code:	**PHZY104CCT**	Semester Exam:	**70 Marks**
Instruction:	**4 h / week**	Duration:	**3 hours**
Credits:	**4**	Internal Assessment:	**30 Marks**

Unit I: Cell Culture and Molecular Biology Techniques:

1.1. Cloning and sequencing of genes and genomics, PCR techniques

1.2. Microarray and gene expression

1.3. Metagenomics and Epigenomics

1.4. Gene targeting and its applications

1.5. Aseptic technique and preparation of media, Bacterial culture

1.6. Types of cell culture, Insect cell culture

1.7. Applications of cell culture

Unit II: Image Analysis and Analytical Techniques

2.1. Bright field; fluorescence; confocal

2.2. Image acquisition and analysis, SEM and TEM

2.3. Colorimetry; Spectrophotometry

2.4. Preparative Centrifugation Chromatography; GC; FPLC; HPLC

2.5. Electrophoresis; MALDI-TOF; LCMS (Mass spectrometry)

2.6. Immmunological techniques, FACS, ELISA, IHC

Unit III: Biostatistics & Bioinformatics:

3.1.Databases, sequences, sequence alignment-pairwise/ multiple, global/ local protein family domain, sequence conservation.

3.2. Introduction to software used for proteomics data analysis

3.3. Basics of Biostatistics

3.4. Software related to statistical data analysis

Unit IV: Model System Organization:

4.1. Pre-requisites of a model system; in vitro systems

4.2. Prokaryotic model organisms; Bacteria and Phages

4.3. Eukaryotic model organisms ; Yeast, *C. elegans* , *Drosophila*, *Xenopus*, Echinus, Zebra fish.

Text Books and References:

1. Research Methodology Methods & Techniques, C.R. Kothari – New Age international Publishers, Reprint 2008.
2. Thesis and Assignment Writing, J. Anderson, Wiley Eastern Ltd., 1997.
3. Research Methodology, Mukul Gupta, Deepa Gupta – PHI Learning Private Ltd., New Delhi, 2011.
4. Fundamentals of Mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons, New Delhi,1999.

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Paper-III-A (Discipline Specific Course)

Immunology of Human Diseases

Paper Code:	**PHZY105DST**	Semester Exam:	**70 Marks**
Instruction:	**4 h / week**	Duration:	**3 hours**
Credits:	**4**	Internal Assessment:	**30 Marks**

UNIT-1: Basis of Human Disease

1.1.Genetic basis of human diseases
1.2. Environmental basis of human diseases
1.3.Complex disorders
1.4. Epigenetics and human diseases
1.5. Molecular methods of disease diagnosis

UNIT- 2: Basic Immunology

2.1. Anatomy and histology of immune system
2.2. Humoral and Cell mediated immune responses.
2.3. Recognition and effector mechanisms of cell mediated and humeral immune responses
2.4. HLA and human diseases
2.5. Inflammation, Immune tolerance and autoimmunity

UNIT-3: Immunology of Pregnancy and Infertility

3.1. Immunology of Non-pregnant uterus
3.2. Immunology of oocyte growth and female immune response to seminal fluid
3.3. Peri-implantation of embryo development and immunology of implantation
3.4. Genetic disparity and Immunological Paradox of Pregnancy
3.5. Immunology of pregnancy related disorders with special emphasis on recurrent pregnancy loss (RPL) and infertility
3.6. Management strategies and therapeutic target of RPL

UNIT-4: Lung immunology in health and disease

4.1. Anatomy, Physiology and immunology of Lung
4.2. An overview of Respiratory disorders
4.3. Immunology and genetics of allergy
4.4. Pathophysiology of Asthma
4.5. Immunology of Asthma
4.6. Management and therapeutic targets of asthma

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Paper-III-B (Discipline Specific Course) Cancer Biology

Paper Code:	**PHZY106DST**	Semester Exam:	**70 Marks**
Instruction:	**4 h / week**	Duration:	**3 hours**
Credits:	**4**	Internal Assessment:	**30 Marks**

Unit I: Basics of cancer:

1.1. Cell Cycle and checkpoints

1.2. Characteristics of Cancer Cells, Hyperplasia and Neoplasia

1.3. Characteristics of Metastatic Cancer Cells

1.4. Types and Classification of Cancers

1.5. Causes of cancer, Carcinogens, Mutagens, and Oncogenic viruses

Unit II: Cancer Genetics

2.1. Oncogenes and Tumor Suppressors genes

2.2. pRb and Control of the Cell Cycle

2.3. p53 and Apoptosis: Master Guardian and Executioner

2.4. Cell Immortalization and Tumorigenesis

2.5. Multi-Step Tumorigenesis

2.6. Cytoplasmic Signaling Circuitry

2.7. Invasion and Metastasis

Unit III: Management of the disease:

3.1. Screening and diagnostic methods

3.2. Tumor Immunology & Immunotherapy

3.3. Rational Treatment of Cancer

3.4. Traditional chemotherapeutics and Radiotherapy

3.5. Stem Cells and Cancer

3.6. Vaccine

3.7. Future of cancer research

Unit: IV: Cervical Cancer:

4.1. Epidemeology and Natural history of cervical cancer

4.2. Premalignant Process; CIN

4.3. Symptoms and Risk factors

4.4. Role of HPV in development of cervical cancer

4.5. Cytological detection of cervical cancer, precancerous and cancerous lesions

4.6. Prevention and management strategies

4.7. Cervical cancer Vaccination

Reference books:

* Molecular Biology of Cancer: Mechanisms Targets and Therapeutics, 2nd"Edition by Lauren Pecorino. Oxford University Press. 2009.
* The Biology of Cancer by Robert Weinberg, Second edition, 2014
* The Biology of Cancer by Robert A Weinberg , Robert A. Weinberg, Garland Science; 1 edition (2006)
* Introduction to Cancer Biology by Robin Hesketh, Cambridge University Press. 2012.
* Cancer Biology by Roger J.B. King, Mike W. Robins. Benjamin Cummings; 3 edition, 2006.

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Paper-III – C (Discipline Specific Course)

Aquatic Toxicology

Paper Code:	**PHZY102DST**	Semester Exam:	**70 Marks**
Instruction:	**4 h / week**	Duration:	**3 hours**
Credits:	**4**	Internal Assessment:	**30 Marks**

Unit I: Laboratory Management

- Maintenance of Experimental fish
- Aquatic animal Handling and restrains
- Water quality criteria for fish
- Physical properties of water
- Chemical Analyses of water
- Feeding Methods
- Routes of doses and sample collection

Unit II: Fish Physiology and Biochemistry

- Water as a biological medium- Gas exchange; Osmoregulation; Excretion
- Fish immune system and important endocrine glands,
- Immuno-endocrine interactions
- Muscle physiology.
- Physiological response to environmental stress
- Stress hormones; stress adaptation and Stress protein.
- Biochemical indicators of Oxidative stress
- Xenobiotic metabolism in fish.
- Biomarkers in Aquatic animals.

Unit III: Aquatic Animal Health

- Principles of disease diagnosis in fish.
- Techniques in health management: Microbiological, haematological, histopathological, imunological and molecular techniques;
- Biochemical tests: Antibody and nucleic acid based diagnostics.
- Immunoparasitology.
- Stress protein
- Health management and Herbal immunostimulants
- Feed formulation and Preparation of artificial feeds.

Unit iv: Aquatic pollution

- Aquatic pollution-Classification of water pollution
- Biological effects of organic matter.
- Toxicity of Industrial effluents and Petroleum Hydrocarbons
- Pesticide types and categories.
- Bioaccumulation and Biomagnification
- Biotransformation of Xenobiotics in fish.
- Toxicity tests-Toxicant bioassay using fish
- Methods of Toxicological analysis

Reference Books

* APHA, AWWA, WPCF. 1998. Standard Methods for the Examination of Water and Wastewater, 20th Ed. American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington, D. C.
* ADCP (Aquaculture Development and Co-ordination Programme). 1980. Fish Feed Technology. ADCP/REP/80/11. FAO.
* Halver J & Hardy RW. 2002. Fish Nutrition. Academic Press.
* Carvalho GR & Pitcher TJ. (Eds.). 1995. Molecular Genetics in Fisheries. Chapman & Hall.
* Reddy PVGK, Ayyappan S, Thampy DM & Krishna G. 2005. Text book of Fish Genetics and Biotechnology. ICAR.
* Kanakaraj P. 2001. A Text Book on Animal Genetics. International Book Distributing Co.
* Iwama G & Nakanishi T. (Eds.). 1996. The Fish Immune System - Organism, Pathogen and Environment. Academic Press.
* Wedmeyer G, Meyer FP & Smith L. 1999. Environmental Stress and Fish Diseases. Narendra Publ. House.
* Hoar WS, Randall DJ & Donaldson EM. 1983. Fish Physiology. Vol. IX. Academic Press.
* Stumm W & Morgan JJ. 1996. Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters. John Wiley & Sons.
* Hoffman DJ. 1995. Handbook of Ecotoxicology. Lewis Publ.
* Kumar A. (Ed.). 2008. Aquatic Environment and Toxicology. Daya Publ. House.
* Mayer H. 1977. Aquatic Toxicology and Hazards Evaluation. ASTM Publ.
* Dhevendaran K. 2008. Aquatic Microbiology. Daya Publ. House.

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Paper-IV

RESEARCH AND PUBLICATION ETHICS

Syllabus in detail

THEORY

- **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

PRACTICE

- **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