

**Syllabus for M. Phil. Course in Zoology
(For Session 2020-2022 Onwards)**



**Department of Zoology
The University of Burdwan
Burdwan 713104
West Bengal**

Course Structure

Semester	Course Code	Courses	Marks	Credits
I	MPSZO-101	Research Methodology	50	4
	MPSZO-102	Research & Publication Ethics	25	2
	MPSZO-103	Applications of Techniques in Zoology	50	4
	MPSZO-104	Term paper(s) & Seminar presentation (s)	50 (25 + 25)	4
		Total	175	14
II	MPSZO-201	Core Course: Advanced Techniques and Methods	50	4
	MPSZO-202	Elective Course: <i>Student will opt any one of the elective courses</i>	50	4
	MPSZO-203	Term paper(s) & Seminar presentation (s)	50 (25 + 25)	4
		Total	150	12
III & IV	MPSZO-301	Dissertation	150	12
	MPSZO-401	Viva Voce	50	4
		Total	200	16

SEM- I

COURSE: MPSZO- 101

(Research Methodology)

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

Five questions (out of eight) of 1 marks each, two questions (out of four) of 5 marks each and one question (out of two) of 10 marks each are to be answered

1. Sampling and data collection: Sampling methods, experimental data, field data, survey data, estimation of sample size 3L
2. Statistical Methods: Parametric and non-parametric test, Laws of probability, Multivariate analysis, Area under curve, Principal component analysis, Survival analysis, Vital statistics in relation to disease epidemiology 8L
3. Model organisms: Introduction to model organism, Definition, Types, Characteristics. Model organism in biological research: *Dictyostelium discoideum*, Yeast, Hydra, *Caenorhabditis elegans*, *Drosophila*, *Zebrafish*, Mouse. 6L
4. Field biology methods: Characterization of habitat and population study, Scaling laws 4L
5. Bioinformatics: Database searching, Sequence alignment, Structure prediction, Molecular phylogeny 5L
6. Concept of IPR, Brief outline of Indian Patent rule, patent procedure, International patent system – PCT, Patent database and searching – in PASS, EPO, USPTO 4L
7. Computer applications: Network concept, Computer cluster, Super computer, Remote computation platform – Biogrid India, Search engines, Online resources, BioGRID 5L

Suggested readings:

Kothari, C. R. (2004). *Research Methodology. Methods and Techniques*. New Age International (P) Limited.

Ronald, N. F., Eun, S. E. & Michael, H. (2007). *Biostatistics. A guide to Design, Analysis, and Discovery*. Academic Press.

Rastogi, V. B. (2015). *Biostatistics*. Scientific International Pvt. Ltd.

WHO (2003). *Laboratory Biosafety Manual*

DBT (1990). *Recombinant DNA safety guidelines and regulation*

DBT (2011). *Guidelines and Handbook for Institutional Biosafety Committee (IBSC)*

Manual of Patent office practice and Procedure (2011). THE OFFICE OF CONTROLLER GENERAL OF PATENTS, DESIGNS & TRADEMARKS.

Tenenbaum, A. S & Wetherhall, D. J. (2013). *Computer Networks*. Pearson

Zar, J. H. (1999). *Biostatistical analysis*. Pearson Education Inc., New Delhi, India

COURSE: MPSZO- 102

Time: 1 hr.

Full marks: 25 (Credit: 2)

Lectures: 18

(Research and publication Ethics)

Five questions (out of eight) of 1 marks each, two questions (out of two) of 5 marks each and one question (out of two) of 10 marks each are to be answered

THEORY

1. Philosophy and Ethics: Introduction to Philosophy: definition, nature and scope, concept, branches; Ethics: Definition, moral philosophy, nature of moral judgments and reactions
2L
2. Scientific Conduct: Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP); Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data
4L
3. Publication Ethics: Definition, introduction and importance; Best practices/standards setting initiatives and guidelines: COPE, WAME etc.; Conflicts of interest; Publication misconduct: Definition, concept, problems that lead to unethical behavior and vice versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals
6L

PRACTICE

4. Open Access Publishing: Open access publications and initiatives; SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies; Software tool to identify predatory publications developed by SPPU: UGC-CARE list of journals; Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.
2L
5. Publication Misconduct: *A. Group discussions*–Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: examples and fraud from India and abroad; *B. Software tools* – Use of plagiarism software like Turnitin, Urkund and other open source software tools
2L
6. Databases and research metrics:*A. Databases*– Indexing databases; Citation databases: Web of Science, Scopus etc.; *B. Research Metrics*–Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore; Metrics: h-index, g-index,i-10 index, altmetrics
2L

COURSE: MPSZO- 103

(Applications of Techniques in Zoology)

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

Five questions (out of eight) of 1 marks each, two questions (out of four) of 5 marks each and one question (out of two) of 10 marks each are to be answered

1. Microscopy: Principles of Light Microscope (LM), Fluorescence Microscope, Confocal Microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) 3L
2. Histological and Histochemical methods: Tissue preparation for light microscopy, SEM, TEM, Ultramicrotomy, Staining, Laser Micro Dissection (LMD) 3L
3. Cell culture techniques, Adherence and suspension culture, Cryofreezing, Animal cell for microbial research 4L
4. Techniques in toxicological study 3L
5. Techniques in nutrition studies: Nutrient evaluation, Digestibility determination, Nutrigenomics 3L
6. Biosystematics: Cladistics: Theory, character coding, character polarity, tree building techniques; Parsimony analysis; Parametric phylogenetics; Keys: Types and Methods of construction; Important rules of ICZN 5L
7. Spectroscopy: UV-VIS, IR, Spectrophotometry, Spectrofluometry, Mass spectroscopy, NMR 3L
8. Chromatography: HPLC, FPLC, Gas chromatography 2L
9. Microbial techniques: Sterilization techniques: Physical methods (Dry heat, moist heat, radiation and filtration) and Chemical methods (alcohol, aldehyde and inorganic chemicals); Bacterial culture methods 3L
10. Allergy: Background of allergy, Different types of allergy & symptoms, Mechanism of allergic reactions, Diagnostic methods, Genomic approach of allergy, Therapeutic approach 4L

Suggested readings:

- Bancroft, J. D. & Gamble, M. (2002). *Theory & practice of Histological Technique*. Churchill Livingstone.
- Chen, M-H., Kuo, L. & Lewis, P.O. (2014). *Bayesian phylogenetics: methods, computational algorithms, and applications*. CRC Press, Taylor & Francis group, A Chapman & Hall book.
- Forey, P. L., Humphries, C. J., Kitching, I.J., Scotland, R. W. & Siebert, D. (1993). *Cladistics – A practical course in systematics*. Oxford University Press.

- Friefelder, D. (1982). *Physical Biochemistry*. W. H. Freeman & Co. (Reprint 1999).
- Hayat, M. A. (ed.) (1970-1978). *Principles and Techniques of Electron Microscopy: Biological Applications*. 2nd edition. vanNostrand Reinhold, New York.
- International Commission on Zoological Nomenclature (1999). *International Code of Zoological Nomenclature*. 4thed. The International Trust for Zoological Nomenclature.
- Kapoor, V. C. & Kapoor, M. (2012). *Theory and Practice of Animal Taxonomy*. Oxford and IBH. 7th ed.
- Kiernan, J. A. (1999). *Histology and Histochemical Methods: Theory & Practice*. 3rd ed, Butterworth Heinemann.
- Kitching, I. J., Forey, P. L., Humphries, C. J. & Williams, D. (1998). *Cladistics: Theory and Practice of Parsimony Analysis (Systematics Association Special Volumes)*. 2nd ed. OUP Oxford.
- Livingstone, C. & Weesner, F. M. (1965). *General Zoological Techniques*. The William & Wilkins Company
- Mayr, E. & Ashlock, P. D. (1991). *Principles of Systematic Zoology*. 2nd ed. McGraw-Hill.
- Quicke, D. A. J. (1993). *Principles and Techniques of Contemporary Taxonomy*. Blackie Academic and Professional.
- Scott-Ram, N. R. (1990). *Transformed cladistics, taxonomy and evolution*. Cambridge University Press.
- Sharma, B. K. (1991). *Techniques in Microscopy and Cell Biology*. Tata-McGraw Hill.
- Sharma, V. K. (1991). *Techniques in Microscopy and Cell Biology*. Tata-McGraw Hill.
- Spencer, M. (1982). *Fundamentals of Light Microscopy*. Cambridge University Press, Cambridge.
- Stoward, P. J. & Everson Pearse, A. G. (1991). *Histochemistry: Theory and Practical*. 4th ed.
- Wilson, K., & Walker, J. (eds.) (2001). *Principles & Techniques of Practical Biochemistry*. 5th ed. Cambridge University Press.

COURSE: MPSZO- 104
(Term paper)

Full marks: 50 (Credit: 4)

Term paper submission:	25
Seminar presentation and interaction:	25 (15+10)

SEM- II

COURSE: MPSZO-201
[Core Course]

(Advanced Techniques and Methods)

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

Five questions (out of eight) of 2 marks each, four questions (out of six) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

1. Molecular biology and recombinant DNA methods: Isolation and purification of nucleic acids; gene expression; Real time PCR, Microarray methods; Chromosome painting; Bar coding, NGS.MALDI –TOF 10L
2. Immunological Techniques: Immunodiffusion, Immune electrophoresis; Different types of agglutination reaction, Antibody engineering, Different types of Immunoassays, ChIP assay, CoIP. Flow Cytometry and Fluorescence-Activated Cell Sorting 10L
3. Microbiological Techniques: Isolation of genomic and plasmid DNA from bacteria, Using of biochemical and molecular markers to identify bacterial strains 5L
4. Advanced Microscopy: Field emission SEM, Super resolution confocal microscopy, Atomic force microscopy, Imaging and image processing, live cell imaging 7L
5. Histochemical localization and detection: Cholesterol, Protein and Bound lipids 3L

Suggested readings:

- Bancroft, J. D. & Gamble, M. (2002). *Theory & practice of Histological Technique*. Churchill Livingstone.
- Cochet, O., Teillaud, J-C. & Sautés, C. (1998). *Immunological Techniques Made Easy*. Wiley-Blackwell.
- Friefelder, D. (1982). *Physical Biochemistry*. W. H. Freeman & Co. (Reprint 1999).
- Hayat, M. A. (ed.). *Principles and Techniques of Electron Microscopy: Biological Applications*. 2nd edition. vanNostrand Reinhold, New York, vol. 1 of series published 1970-1978.
- Kiernan, J. A. (1999). *Histology and Histochemical Methods: Theory & Practice*. 3rd ed, ButterworthHeinemann
- Kumar, A. (2011). *Molecular Biology and Recombinant DNA Technology: Practical Manual Series (Volume II)*. Narendra Publishing House.
- Paulsen, I. T. & Holmes, A. J. (2014). *Environmental Microbiology*. Human Press.
- Sharma, V. K. (1991). *Techniques in Microscopy and Cell Biology*. Tata-McGraw Hill.
- Spencer, M. 1982. *Fundamentals of Light Microscopy*. Cambridge University Press, Cambridge.
- Wilson, K., & Walker, J. (eds.) (2001). *Principles & Techniques of Practical Biochemistry*. 5th ed. Cambridge University Press.

COURSE: MPSZO – 202

[Elective Course: Student may opt any one of these optional courses]

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Five questions (out of eight) of 2 marks each, four questions (out of six) of 5 marks each and two questions (out of four) of 10 marks each are to be answered

AQUACULTURE

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

1. Fish breeding: Neuroendocrine control, Breeding with hormone analogs, Sex-pheromone in fish reproduction 6L
2. Aqua feed and Nutrition: Natural food organisms and their culture, Proximate composition of feed and feed ingredients, Formulation of non-conventional fish feed, Anti-nutritional factor, Probiotics and prebiotics 8L
3. Fish Biotechnology: Preservation of gametes, Hybridization, Polyploidy, Monosexculture, Transgenesis, Sex reversal 6L
4. Culture Practices: Integrated aquaculture with carp and live stock farming, Reproduction and Larval rearing of catfishes, Fresh water prawns, Algae culture 5L
5. Fish and shellfish diseases, Methods of disease diagnosis 6L
6. Immunity in Fish; Vaccination 4L

Suggested reading:

Bardach, J. E. & Ryther, J. H. (1972). *Aquaculture*. John Willey and Sons.

Beaumont, A. R. & Hoare, K. (2003). *Biotechnology & Genetics in Fisheries and Aquaculture*. Blackwell Publishing.

Bond, C. E. (1996). *Biology of Fishes*. 2nd ed. Saunders Pub.

Chakrabarti, N. M. (1998). *Biology, Culture and Production of Indian Major Carps – A Review*. Narendra Publishing House. New Delhi.

Chakraborty, N. M., Chakraborty, P. P. & Mandal, S. C. (2010). *Biology, Breeding & Farming of Important Food Fishes*. Narendra Publishing House. New Delhi.

Evans, D. H. (1998). *The Physiology of Fishes*. CRC Press.

ICAR (2011). *Hand Book of Fisheries & Aquaculture*. 2nd Ed. ICAR, New Delhi

Jhingran, V. G. (1991). *Fish and Fisheries of India*. 3rd ed. Hindusthan Pub. Corp.

Kumar, R. (2011). *Biotechnology & Genetics in Fisheries and Aquaculture*. Arise Pub., Delhi Pillay, T. V. R. (1993). *Aquaculture*. Fishing News Books.

Reddy, P. V. G. K., Ayyappan, S., Thampy, D. M. & Krishna, G. (2005). *Textbook of Fish Genetics and Biotechnology*. ICAR, New Delhi.

Singh, K. K. (2011). *Fish Genetics*. Sonali Publication, New Delhi.

Srivastava, C. B. L. (1999). *Fish Biology*. Narendra Pub. House.

ECOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

1. Modeling: Basics-GLM, Non-linear, Prey-Predator interactions, Life History Traits and evolutions, Social Behaviour and Evolution
2. Allelochemicals: Occurrence, Modes of allelochemicals release, Volatilization, Leaching, Root exudates, Decomposition of residues, Origin and nature of allelochemicals, Factors affecting products of allelochemicals, Mode of action of allelochemicals
3. Chemical Ecology: Plant as insect food, Host-plant selection mechanism, Elucidation of primary and secondary substances, mechanism of plant resistance, Endocrine system of herbivores listens to host-plant signals, Insects pheromones 8L
4. Field Methods: Methods of estimating population density of animals and plants, ranging pattern through direct, indirect and remote observations, Sampling methods in the study of behavior, Habitat characterization, ground and remote sensing methods 7L
5. Conservation and Biodiversity: Megadiversity zone; Hotspot concepts: Distribution, Importance; Biodiversity indices; Principles of conservation; Conservation laws; Conservation of natural resources 6L

Suggested readings:

- Begon, M., Harper, J. L. & Townsend, C. R. (2006). *Ecology: Individuals, Populations and communities*. 4th ed. Blackwell science.
- Enger, E. D. & Smith, B. F. (2008). *Environmental Science: A study of Interrelationships*. 11th ed. McGraw-Hill Higher Education.
- Groom, M. J., Meffe, G. K. & Carroll, C. L. (2005). *Principles of Conservation Biology*. 3rd ed. Sinauer Associates Inc. Publishers, USA.
- Harborne, J. B. (2003). *Introduction to Ecological Biochemistry*. Academic Press, London.
- Hunter, M. L. Jr. & Gibbs, J. P. (2006). *Fundamentals of Conservation Biology*. 3rd ed. Wiley-Blackwell.
- Krebs, C. J. (1999). *Ecological Methodology*, II edn. Benjamin Cummings, California.
- Pullin, A. S. (2002). *Conservation Biology*. Cambridge University Press.
- Ricklefs, R. E. & Miller, G. L. (2000). *Ecology*. 4th ed. W. H. Freeman & Company.
- Saharia, V. B. (1998). *Wildlife in India*. Natraj Publishers.
- Sinclair, A. R. E., Fryxell, J. M. & Caughley, G. (2009). *Wildlife Ecology, Conservation and Management*. Wiley.
- Smith, R. L. and Smith T. M. (2001). *Ecology and Field Biology*. VI ed. Benjamin Cummings, California.
- Smith, T. M & Smith, R. L. (2006). *Elements of Ecology*. 6thed. Pearson Education.
- Sodhi, N. S. & Ehrlich, P.R. (2010). *Conservation Biology for all*. Oxford Biology, USA.
- Stiling, P. (2002). *Ecology- Science and Applications*. 2nd ed. Prentice Hall of India

ENTOMOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

1. Insect Pest Management: Sampling techniques; Degree Day Method; Dynamics of Economic Injury Level (EIL); Tools for Biological Control; Measuring Impacts; Safety issues 8L
2. Molecular Mechanism of plant resistance; Host-plant selection – Mechanism; Case studies; applications 6L
3. Hormonal regulation: Moulting, Diapause and Vitellogenesis 5L
4. Role of symbionts in digestion 2L

6L

8L

5. Insect Molecular Genetics: *Drosophila* genome project; Genetic analysis of Insect behaviour; Molecular Ecological Methods
6. Genetic Engineering: Plants for Insect resistance; Biocontrol agents

Suggested reading:

- Abrol, D. P. (Ed.) (2013). *Integrated Pest Management: Current Concepts and Ecological Perspective*. Academic Press.
- Chapman, R. F., Simpson, S. J. & Douglas, A. E. (2012). *The Insects: Structure and Function*. 5th ed. Cambridge University Press.
- Gilbert, L. I. (Ed.) (2009). *Insect Development: morphogenesis, molting and metamorphosis*. Academic Press.
- Gilbert, L. I. (Ed.) (2012). *Insect Endocrinology*. Academic Press.
- Gilbert, L. I. (Ed.) (2012). *Insect Molecular Biology and Biochemistry*. Academic Press.
- Hoy, M. A. (2013). *Insect Molecular Genetics– An introduction to principles and Applications*. 3rd ed. Academic Press.
- Klowden, M. (2013). *Physiological Systems in Insects*. 3rd ed. Academic Press.
- Nation, J. L. (2008). *Insect Physiology and Biochemistry*. 2nd ed. CRC Press. Taylor and Francis Group.
- Pedigo, L. P. & Rice, E. M. (2009). *Entomology and Pest Management*. Pearson/Prentice Hall.
- Radcliffe, E.B., Hutchinson, W.D. & Cancelado, R.E. (2009) *Integrated Pest Management – Concepts, Tactics, Strategies and Case studies*. Cambridge University Press.
- Schoonhoven, L. M., van Loon J. J. A. & Dicke, M. (2006). *Insect-Plant Biology*. 2nd ed. Oxford University Press.
- Speight, M. R., Hunter, M. D. & Watt, A. D. (2008). *Ecology of Insects: Concepts and Applications*. 2nd ed. Wiley-Blackwell

ENVIRONMENTAL TOXICOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. General Introduction of environmental toxicology Concepts | 4L |
| 2. Pollutant types and sources: Petroleum, Aromatic Hydrocarbons, Halogenated hydrocarbons, Organophosphate and organochlorine pesticides, Pyrethroids | 4L |
| 3. Toxicity testing, Cellular dysfunction | 5L |
| 4. Genetic toxicology | 3L |
| 5. Concept of bioassay | 3L |
| 6. Benthic community analysis | 4L |
| 7. Biomarkers and Endocrine disruptors | 5L |
| 8. Environmental toxicology and impact in Fish, insects, mammals and human health | 4L |
| 9. Prevention and Control of environmental pollution and legislation | 3L |

Suggested readings:

- De, A. K. (2000). *Environmental chemistry*. 4th ed. New Age International (P) Ltd. Publishers.
- Duffus, J.H. & Worth H.G.J. (Ed.) (2006). *Fundamental Toxicology*. RSC publishing.
- Hughes, W. (2003). *Essentials of Environmental Toxicology*. CRC Press.
- Klaassen, C. D. (Ed.) (1996). Casarett & Doull's *Toxicology: The Basic Science of Poisons*. 5th ed. McGraw-Hill, New York.
- Lu, F. C. (1996). *Basic Toxicology: Fundamentals, Target organs and Risk Assessment*. 3rd ed. Taylor & Francis.

- Pandey, K., Shukla, J. P. & Trivedi, S. P. (2005). *Fundamentals of Toxicology*, New Central Book Agency (P) Ltd. Kolkata.
- Philip, R. B. (2016). *Ecosystems and Human Health: Toxicology and Environmental Hazards*, Second Edition. CRC Press.
- Plant, N. (2003). *Molecular Toxicology*, 1st Ed. Bios Scientific Publishers.
- Richardson, M. (2002). *Environmental Toxicity Assessment*. CRC Press.
- Rose, J. (2003). *Environmental toxicology*. CRC Press.
- Stine, K. E. & Brown, T. M. (2006). *Principles of Toxicology*. 2nd Ed. CRC, Taylor & Francis Group, New York.
- Timbrell, J. (2002). *Introduction to Toxicology*, 3rd Ed., Taylor & Francis, London.
- Walker, C. H., Hopkin, S. P., Sibly, R. M. & Peakall, D. B. (2000). *Principles of Ecotoxicology*, 2nd Ed. Taylor & Francis, London.
- Moriarty, F. (1999). *Ecotoxicology: The study of pollutants in ecosystems*. 3rd Ed. Elsevier.

HUMAN GENETICS

Time: 2 hrs. Full marks: 50 (Credit: 4)

Lectures: 35

1. Monogenic disorders	3L
2. Polygenic traits and diseases	3L
3. Twin study	3L
4. Gene therapy	3L
5. Eukaryotic Genome and Human Genome project	3L
6. Rare and polymorphic variations, Haplotype, TagSNP, dbSNP, HGNC	3L
7. Rare genetic disorders, Autism spectrum disorder and others	3L
8. Cancer	3L
9. Epigenetic modification and diseases	3L
10. Chromosomal aberrations and syndromes	3L
11. Cell Signalling	3L
12. Cell cycle control mechanism	2L

Suggested readings:

- Brockman, J. (2016). *Life: The Leading Edge of Evolutionary Biology, Genetics, Anthropology and Environmental Science*
- Chopra & Tanzi (2015). *Super Genes*
- Gangane, S. D. (2012). *Human Genetics*.
- Gangane, S. D. (2017). *Human Genetics*, 5e
- Gardner, A. (2012). *Human Genetics*
- Harris & Hirschhorn (2013). *Advances in Human Genetics*
- Jackson, T. (2017). *The Human Body in Minutes*
- Jobling, Hollox, Kivisild & Tyler-Smith (2013). *Human Evolutionary Genetics*
- Kenneally, C. (2014). *The Invisible History of the Human Race: How DNA and History Shape Our Identities and Our Futures*.
- Kulkarni, K. (2012). *Essentials of Human Genetics*
- Lakshmaiah & Ashok (2011). *Anthropology Volume - I (human genetics)* [English medium]
- Marcus, A. (2010). *Human Genetics: An Overview*
- Mukherjee S. (2016). *The Gene: An Intimate History*

- Pal, G.P. (2011). *Medical Genetics*
 Relethford, J. H. (2012). *Human Population Genetics* (Foundation of Human Biology).
 Shukla & Rastogi. (2012). *Physical anthropology and human genetics*
 Stevenson & Hall (2015) *Human Malformations and Related Anomalies* (Oxford Monographs on Medical Genetics)
 Strachan & Read (2010). *Human Molecular Genetics*
 Swani, D. (2016). *Human Genetics for Nurses*
 Trivedi & Shrimankar (2016). *Kapur & Suri'S Basic Human Genetics*
 Zschocke, Schaaf & Potocki (2011). *Human Genetics: From Molecules to Medicine*

IMMUNOLOGY

Time: 2 hrs. Full marks: 50 (Credit: 4)

Lectures: 35

1. Organs of the immune system: lymph node microanatomy, Immunology of mucosal surfaces, Gut immune system
4L
2. Cells of the immune system: B-lymphocyte and T-lymphocyte: Maturation, Activation and differentiation with special emphasis on Macrophage types and dynamics, Receptors and Cell signaling pathways: TLRs, MyD88 and JAK-STAT 6L
3. Antigen presentation: Major histocompatibility complex and Antigen processing and presentation; MHC-restriction 1L
4. Immunoglobulin Diversity: Diversity and functions from fish to mammal 4L
5. Immunological Disorders: Autoimmune diseases and health problem 5L
6. Vaccine research: Challenges of *Leishmania*, *Trypanosoma*, *Plasmodium*, *Giardia*, HIV 5L
7. Immune evasion strategies: Dengue, *Helicobacter pylori*, *Trypanosoma*, and *Schistosoma* 5L
8. Transplantation: Graft versus host response, HLA typing 2L
9. Tumor immunology: Tumor antigens and metastasis of cancer cells 3L

Suggested readings:

- Abbas, A. K., Lichtman, A. H. & Pillai, S. (2006). *Cellular and molecular Immunology*. 6th ed. Saunders.
 Abbas, A. K. & Lichtman, A. H. (2006). *Basic Immunology*. 2nd ed. Elsevier.
 Chakraborty, A. K. (2003). *Immunology II*. 2nd ed. N. L. Publishers Siliguri.
 Coico, R., Sunshine, G. & Benjamini, E. (2003). *Immunology: A short Course*. 5th ed. Wiley-Liss: New Jersey.
 English, L. S. (1994). *Technological Applications of Immunochemicals (BIOTOL)*. Butterworth-Heinemann, Oxford Freeman & Co. Goldsby,
 Kindt, R. A., Kuby, T. J. & Osborne, B. A. (2003). *Immunology*. 5th ed.
 Freeman, W. H. & Co. Khan, F. H. (2009) *The Elements of Immunology*. Pearson.
 Kindt, T., Goldsby, R. & Osborne, B. (2007). *Immunology*. 6th ed.
 Rao, C. V. (2002). *Immunology*. Narosa Publishing House, New Delhi.
 Roitt, I. M. & Delves, P. J. (2001). *Roitt's Essential Immunology*. 10th ed. Blackwell Science. Ltd

MICROBIOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

1. Microbial taxonomic methods: Phenotypic, biochemical and molecular methods 7L

2. Recognition and entry processes of pathogenic bacteria and viruses into animal host cells. Detection of bacteria from stool and urine sample. Examination of sputum sample for the detection of *Mycobacterium tuberculosis*
7L
3. Types and mechanisms of drug resistance 7L
4. Microbial fermentation and production of micro- and macromolecules 7L
5. Bacteriology of milk. Microbiological analysis of milk and food product 7L

Suggested readings:

- Alexander, M. (1977). *Introduction to Soil Microbiology*. John Wiley & Sons.
- Atlas, R. M. (1984). *Microbiology, Fundamentals and Applications*. Macmillan & Co. Atlas, R. M. & Bartha, R. (1997). *Microbial Ecology: Fundamentals and Applications*. 4th ed. Benjamin/ Cummings. Menlo Park, California. (Indian Print: Pearson Education)
- Black, J. G. (2011). *Microbiology: Principles and Explorations*, 8th ed. John Wiley & Sons.
- Campbell, R. (1983). *Microbial Ecology*. 2nd ed. Oxford, Blackwell.
- Davis, B. D., Dulbecco, R., Eisen, H. N. & Ginsberg, H. S. (1990). *Microbiology*, 4th ed. Harper and Row. New York. 28
- Dimmock, N. J. & Primrose, S. B. (1994). *Introduction to Modern Virology*. 4th ed. Blackwell Scientific Publications. London. Freifelder, D. *Molecular Biology*. Narosa Publishing House, New Delhi.
- Hyde, J. E. (1990). *Molecular Parasitology*. Open University Press. London.
- Maloy, S. R., Cronan, E. J. & Freifelder, D. (1994). *Microbial Genetics*, 2nd ed. Jones and Bartlett, Boston.
- Pelczar, M. J., Reid, R. D. & Chan, E. C. (1993). *Microbiology*, 5th ed. Tata McGraw Hill.
- Presscott, L. M., Harley, J. P. & Klein, D. A. (2011). *Microbiology*, 8th ed. McGrawHill, New York.
- Schlegel, H.G. (1993). *General Microbiology*. 7th ed. Cambridge University Press.
- Stanier, R. Y., Adelberg, E. A. & Ingraham, J. L. (1986). *General Microbiology*.
- Talaro, K. & Talaro, A. (1999). *Foundations in Microbiology*, 3rd ed. McGraw-Hill.
- Tortora, G. J., Funke, B. R., & Case. C. L. (2008). *Microbiology: An Introduction*. 9th ed. Benjamin/Cummings Publishing.
- Voyleys, B. A. (2002). *The Biology of viruses*. 2nd ed. McGraw-Hill.

MOLECULAR BIOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

1. Apoptosis and Cancer 5L
2. RFLP and RAPD 5L
3. Gel mobility shift assay 3L
4. Yeast two-hybrid method 2L
5. Random and site-directed mutagenesis 6L
6. Antisense technology 6L
7. Stem cell 4L
8. Antibody engineering and Phase display technology 4L

Suggested readings:

- Alberts, B. et al. (2008). *Molecular Biology of the Cell*. 5th Ed. Garland Publishing House.
- Clark, D. P. (2005). *Molecular Biology*. Elsevier.
- Karp, G. (2008). *Cell and Molecular Biology: Concepts and experiments*. 5th ed., John Wiley.

Kendrew, S. J. (Ed.) (1994). *The Encyclopedia of Molecular Biology*. Blackwell Science.
 Watson, J. D., Baker, T. A. & Bell, S. P. (2007). *Molecular Biology of the Gene*. 6th ed. Benjamin Cummings.
 Malacinski, G. M. (2003). *Essentials of Molecular Biology*. 4th ed. Jones & Bartlett.
 Twyman R.M. (2003). *Advanced Molecular Biology*. Viva Books.

PARASITOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. Detection of blood parasites (Malarial parasites and Microfilaria), Stool parasites (<i>Entamoebahistolytica</i>) and Helminth parasites | 9L |
| 2. Host – parasite interaction | 9L |
| 3. Parasitic interaction with animal diversity | 9L |
| 4. Modern methods in parasitic study | 8L |

Suggested readings:

Bird, A. F. (1971). *The structure of Nematodes*. Academic Press, New York.
 Bogitsh, B. J. & Cheng, T. C. (2000). *Human Parasitology*. 2nd Ed. Academic Press, New York.
 Bogitsh, B. J., Carter, C. E. & Oltmann, T. N. (2006). *Human Parasitology*. 2nd Ed. Academic Press, New York.
 Bush, A. O., Fernández, J. C., Esch, G. W. & Seed, J. R. (2001). *Parasitism*: Cambridge University Press. U. K.
 Cheng, T. C. (1986). *General Parasitology*. 2nd ed. Academic Press, Inc. Orlando.U.S.A.
 Chowdhury, N. & Toda, I. (Eds) (1994). *Helminthology*. Narosa Publishing House, New Delhi. Dawes, D., Bakers, J. R. & Muller, R. (Eds). *Advances in Parasitology* (yearly volumes). Academic Press, New York.
 Hati, A. K. (2001). *Medical Entomology*. Allied Book Agency, Kolkata.
 Hyman, L. H. (1951). *The Invertebrates*. (Vols- II, III) McGraw-Hill Book Company.
 Noble, E. R. & Noble G. A. (1989). *Parasitology. The Biology of animal Parasites*. 6th ed. Lea and Febiger, Philadelphia.
 Roberts, L. S. & Janovy, Jr. J. (2006). *Foundations of Parasitology*. McGraw-Hill International Ed.
 Schmid, G. D. (1989). *Essentials of Parasitology*. Wm. C. Brown Publishers (Indian Reprint; 1990. Universal Book Stall).
 Smyth, J. D. (1994). *Animal Parasitology*. 3rd ed. Cambridge University Press.
 Soulsby, E. J. L. (1982). *Helminths, Arthropods and Protozoa of domesticated animals*. ELBS and BailliereTindall.
 Smyth, J. D. & McManus, D. P. (1989). *The Physiology and Biochemistry of cestodes*. Cambridge Univ. Press.

VECTOR BIOLOGY

Time: 2 hrs.

Full marks: 50 (Credit: 4)

Lectures: 35

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1. Vector competence: Determination of sporozoites from salivary gland of infective <i>Anopheles</i> mosquitoes; Determination of filarial parasites from <i>Culex</i> mosquitoes; Determination of helminth parasites from fish and snail vectors. Analysis of insect blood meal | 15L |
| 2. Mosquitoes as transmitters of viral diseases. Isolation technique of Dengue virus from mosquito vectors | 10L |
| 3. Modern techniques and approaches of vector control | 10L |

Suggested readings:

- Chandler, A. C. & Read. C. P. (1961). *Introduction to Parasitology*, 10th ed. John Wiley & Sons Inc.
- Chandra, G. (2000). *Mosquito*. SreeBhumi Publication Co. Kolkata.
- Cheng, T. C. & Bogitsch. *Human Parasitology*.
- Cheng T. C. (1986). 2nd ed. *General Parasitology* Academic Press, Inc. Orlando. U.S.A.
- Cox, F. E. G. (1993). *Modern Parasitology*. 2nd ed. Blackwell Scientific Publications. ed. Lea and Febiger, Philadelphia.
- Hati, A. K. (2001). *Medical Entomology*. Allied Book Agency, Kolkata.
- Hati, A. K. (2001). *Medical Parasitology*. Allied Book Agency, Kolkata.
- Noble, E. R. & Noble G. A. (1989). *Parasitology. The Biology of animal Parasites*. 6th ed.
- Schmidt, G. D. & Roberts, L. S. (2001). *Foundation of Parasitology*, McGraw Hill Publishers, 3rd ed.
- Schmidt, G. D. (1989). *Essentials of Parasitology*. Wm. C. Brown Publishers (Indian print; 1990, Universal Book Stall).
- Smyth, J. D. (1994). *Animal Parasitology*. 3rd ed. Cambridge University Press.
- Soulsby, E. J. L. (1982). *Helminths, Arthropods and Protozoa of domesticated animals*. ELBS and Bailliere Tindall. London.

COURSE: MPSZO– 203

Full marks: 50 (Credit: 4)

Term paper:	25
Seminar presentation and interaction:	25 (15+10)

SEM- III & IV

Course– MPSZO-301 & MPSZO-401

Dissertation (Marks – 150: credit 12)

(Student will undertake one research project under guidance of any faculty members)

Pre-submission Seminar

Viva Voce – (50 marks: credit 4)