MAHATMA GANDHI UNIVERSITY

Ph.D. Course Work – ZOOLOGY

COURSE II – ADVANCES IN ZOOLOGY

Module I. Biodiversity & Taxonomic Studies: Biodiversity, genetic diversity, molecular diversity and taxonomy, DNA bar-coding, Conservation of diversity and endangered species. Collection, Preservation and Identification of Animals. Modern tools of Taxonomy (alpha beta and gamma level taxonomy), Application of molecular and computational tools for Phylogenic and Taxonomic studies (10L).

Module II. Field studies and EIA: Assessment of biodiversity in different types of ecosystems, sampling techniques and quantitative methods for biodiversity assessment. Environmental Impact Assessment (EIA): Definition, concepts & characteristics of EIA; participants, stages & types of EIA. Guidelines for EIA in India. Environmental Impact Statement (EIS) & Environmental Management Plan (EMP). Methods of impact identification (10L).

Module III. Biosafety and Ethics: Guidelines for Bio-safety, functioning of Institutional Bio-safety committee, Institutional Animal ethics committee, and Institutional ethical committee , CPCSEA guidelines for animal experimentation , ICMR guidelines for experiments involving animals and humans, DBT guidelines for Biosafety practices to be followed (5L).

Module IV. Tools and techniques: Principles and applications-

Biochemical and Biophysical techniques-Techniques used for purification and characterization of biomolecules: Principles and applications of Centrifugation, Ultrafilteration, Chromatography - GC and HPLC, Electrophoresis, Blotting techniques-Southern, Northern and Western blotting, Spectrophotometry, X-ray crystallography (10L).

Histology and Histochemistry: Fixation and sectioning of tissue, embryos and cells. Microtomy, Cryotomy, Principles and applications of Immunohistochemistry and Immunoflurosecence, Histochemical staining for characterization of cell type and localization of enzymes, Lipids, Protein and Carbohydrates. (10L).

Microscopic techniques: Specimen preparation for TEM, SEM, shadow casting, freeze fracturing, freeze etching, negative staining, Principles and applications of Electron Microscopy-SEM, TEM, STEM, Fluorescence microscopy, Confocal microscopy, Microphotography (7L).

Cell biology, Molecular biology, Genetic engineering techniques: Principles and applications of PCR and ELISA, Fluorescence *insitu* Hybridization (FISH), DNA microarray, DNA sequencing, Protein Microarray, Protein sequencing, Micronucleus test, Comet assay, Caspase assay and Live /dead cell viability assay method (8L).

Recommended Books

1. Alfred, J.R.B and Ramakrishna. (2004). *Collection, Preservation and Identification of Animals*. Zoological Survey of India Publications, Calcutta.
2. Anne E. Magurran (2004). *Measuring Biological Diversity* .Blackwell Publishing, MA, USA
3. Chakraborty, A.K. (2006). *Immunology and Immunotechnology.* Oxford University Press, New Delhi
4. Chanlett E.T. (1973). Environmental Protection. McGraw Hill, Inc., Japan.
5. Chapman J.L. & M.J. Reiss (2006). Ecology, Principles and Applications. (2nd ed). Cambridge University Press.
6. Cooper, G.M. and Hausman, R.E. (2009). *The cell: A Molecular Approach* (5thed). Sinauer Associates Inc. ASM Press, Washington DC.
7. Daniels, R.J.R and J.Vencatesan (2008). *Western Ghats: Biodiversity, People, Conservation*. Rupa & Co. New Delhi, India.
8. Gupta A. (2009). *Instrumentation and Bio-Analytical Techniques*. PragatiPrakashan, Meerut.
9. Janarthanan S & Vincent S. (2007). Practical Biotechnology, Method of Protocols. University Press.
10. Kapoor ,V.C.(1998). Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.
11. Keith Wilson and John Walker. (2008). *Principles and Techniques of Biochemistry and Molecular biology* (6thed). Cambridge University Press, UK.
12. Koren H. Handbook of Environmental Health and Safety – Principle and Practices; Lewis Publishers
13. Marie, M. (2005). Animal Bioethics: Principles and Teaching Methods. Wageningen Academic Publishers
14. Matsumura, F. (1975). *Toxicology of Insecticides.* Plenum Press New York.
15. Melissa A – Gibbs (2006). A practical Guide to Developmental Biology, Oxford University press (Int. student edition).
16. Metzler, D. E. (2003). *Biochemistry: The Chemical reactions of living cell..* Vol. 1 & 2. Academic Press.
17. Michael Roberts,Tim King and Michael Reiss.(1994). Practical Biology for Advance Level. Thomas Nelson and Sons Ltd. Surrey, UK.
18. Michael T.A. Michael, E.R. and Toya S.K. (1975). Electron Microscopy and Cell Structure. Cambridge University Press
19. Narendran, T.C. (2008). *An introduction to Taxonomy*. Zoological survey of India.
20. Odum, E.P. (1971). Fundamentals of Ecology. W.B. Saunders College Publishing, Philadelphia.
21. Oser, B.L. (1965). *Hawk's Physiological Biochemistry*. Mc Graw Hill Book Co. New Delhi.
22. Palmer Trevor. (2001). *Enzymes: Biochemistry, Biotechnology & Clinical chemistry*. Horwood Publ.Com., England.
23. Pandey Kamleshwar, J.P. Shukla and S.P. Trivedi.(2005). *Fundamentals of Toxicology*. New Central Book Agency (P) Ltd. Kolkata, India
24. Pearse, A.G.E. (1980). *Histochemistry*. Vol. I & II. Churchill Livingstone, NY, USA.

25. Primrose, S.B., Twyman, R.M., and Old, R.W. (2001). *Principle of Gene Manipulation (*6th ed). Blackwell Science Ltd, London.
26. Rajagopalan,R. (2005). *Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.
27. Rupert E. Edward., R. S. Fox and R.D.Barnes. (2006). *Invertebrate Zoology: A Functional Evolutionary Approach.* Thomson/Cole, Singapore
28. Ruxton, G.D. and Colegrave, N. (2006). Experimental design for the life sciences. Oxford University Press.
29. Sandhu, G.S. (1990). *Research Techniques in Biological Sciences*. Anmol Publications, New Delhi.
30. Sateesh, M.K. (2008). Bioethics and Biosafety. I.K. International Publishing House.
31. Saunders, J.W. (1982). *Developmental Biology-Patterns,Principles and Problems.* Macmillan Publishing Co., New York.
32. Singh B.D. (2002). Biotechnology, Kalyan Publishers New Delhi.
33. Squires,E.J. (2003). *Applied Animal Endocrinology*, CABI Publications,UK.
34. Stiling Peter (2002). Ecology: Theories and applications. Prentice Hall of India Pvt. Ltd. New Delhi
35. Switzer, R. L. & Garrity, L. F. (1999). *Experimental Biochemistry*. W. H. Freeman & Company.
36. Weesner, F.M. (1960). *General Zoological Microtechniques*. The Williams & Wilkins Co., Baltimore, USA.
37. Wilson & Walkar (2008). *Principles and Techniques of Biochemistry and Molecular Biology* Cambridge University Press.
38. Wilson E.O. (1988). *Biodiversity*. National Academy press, Washington DC, USA.

Paper II: Advances in Zoology

Time: 3 Hrs. Marks: 80

Part A

Answer any twelve questions from the following (5 marks each)

1. Outline the molecular tools for Phylogenetic studies
2. Enumerate various methods for biodiversity estimation
3. Comment on the role of institutional ethical committee
4. Explain the application of fluorescence microscopy in biological research.
5. What is DNA bar-coding? Explain its application in taxonomic studies.
6. Write an account on collection and preservation procedures for identification of animals.
7. Explain the concept, characteristics and methods of Environment impact assessment.
8. Explain the principle and application of Confocal microscopy.
9. What is Bio-safety? List down important bio-safety practices to be followed in biological research.
10. What is CPCSEA? Explain its role in biological research.
11. Give an account on any two separation methods employed in purification and characterization of biomolecules.
12. Comment on various blotting techniques and their application.
13. Explain PCR, its principle, steps involved and application.
14. Write an account on methods used to study DNA damage at cellular level.
15. Explain any one histochemical procedure and its principle for localization of carbohydrates in tissues.
16. Explain the principle and application of Spectrophotometry in biological research.

Part B

Answer any two questions from the following (10 marks each)

17. Describe the specimen preparation protocol used for Electron microscopic studies.
18. Write an essay on principles and applications of chromatography with special reference to GC and HPLC.
19. Explain the CPCSEA guidelines for animal experimentation.
20. Write an essay on various types of ELISA and its application.