3M courses

Course code	Course title	Lectures & Tutorial (hrs)	Practical and /field (hrs)	Credit value	Recourse person
ZOL 301M2	Wild Life Conservation and Management	20	27 F	02	Dr.Mrs.A.Sivaruban
ZOL 302M3	Limnology	27	30P+9F	03	Mr W. Venkatesh Luckshman and Mrs.P.Sivakumar
ZOL 303M3	Endocrinology	27	30 P+9F	03	Dr T. Eswaramohan
ZOL 304M3	Advanced Molecular Biology and Immunology	27	30 P+9F	03	Prof S.N.Surendran and Dr K.Gajapathy
ZOL 305M3	Pest Management	27	30 P+9F	03	Prof S.N.Surendran; Prof.Mrs.R.Gnaneswaran and Ms Nithiyagowry Ratnasabapathy.
ZOL 306M2	Environmental Toxicology	20	24P+9F	02	Prof S.N.Surendran and Dr Mrs.T.William Shanthakumar
ZOL 307 M2	Research Methodology and Data Analysis	20	24 (P)	02	Prof S.N.Surendran; Prof.Mrs.R.Gnaneswaran; Dr T. Eswaramohan and Dr.Mrs.A.Sivaruban
TOTAL				**18**	

Title of the Course Unit	Wild Life Conservation and Management		
Course Code	ZOL 301M2		
Credit Value	2		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning
	20	27	53
Objective/s	• Impart knowledge on the concepts of wild life management and the importance of wildlife		
Intended Learning Outcomes	• Describe wild life management strategies; • Explain global and local wild animal diversity and conservation status Discuss the key elements for the management of wild animals; • Illustrate wild life monitoring strategies and estimation of wild life population • Express the assessment of management practices and evaluate case studies.		
Contents	Wild life definition and conservation priorities Conservation status and extinction criteria - examples of animals from the world and Sri Lanka Introduction to genetic diversity and terminology used in genetic diversity Consequences of small population size Wild life management Practices - Key elements for the management of wild animals; - Importance of wild life in maintaining the balance of nature, examples - Captive breeding and reintroduction, case studies- (success and failure). - Genetic management- Constrains and Anthropogenic activities in WildlifeManagement.		
Teaching learning Methods/Activities	**Theory**: In-person lectures learning in laboratory and field; oral presentation - individual / group assignments		
Evaluation/Assessment Strategy	**Theory:** In-course assessment(s): (30%) End of course examination: (70%) **Practical**: In-course assessment(s): (30%) End of course examination: (70%)		

Recommended References	• Frankham, R., Ballou, JD., and D. A. Briscoe. A. Prime of Conservation Genetics. Cambridge University Press,UK. 2004 • Fryxell, John M., Anthony RE Sinclair, and Graeme Caughley. *Wildlife ecology, conservation, and management*. John Wiley & Sons, 2014.Silvy, Nova J., ed. *The Wildlife Techniques Manual: Volume 1: Research. Volume 2: Management 2-vol. Set*. Vol. 1. JHU Press, 2012.

Title of the Course Unit	Limnology		
Course Code	ZOL 303M3		
Credit Value	3		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning
	27	39	84
Objective/s	• Illustrate the characteristics of inland freshwater ecosystems and to discuss the significance of limnology in inland freshwater ecosystems; • Introduce the specific biological needs and adaptations of limnology complexes; • Impart knowledge on the diverse evolutionary adaptations of organisms along the succession of inland aquatic ecosystems		
Intended Learning Outcomes	• Identify and Estimate the characters of freshwater types from nature. • Estimate the biological compositions of freshwater ecosystems		

	• Analyze species specific adaptations and their respective ecological factors. Apply the knowledge on natural water problems cited
Contents	Rivers and Lakes – their distribution, origin and forms, Water economy, Light penetration in inland waters, fate of Heat – Temperature and pH fluctuations, Water movements, Structure and productivity of aquatic ecosystems, Oxygen, Salinity of inland waters, Inorganic carbon complex, Nitrogen cycle, Phosphorous cycle, and Sulphur and Silica cycles, Plankton communities –algae, cyano-bacteria, Zooplanktons and their interactions with fish, Bacteria-planktons, Land-water interfaces, shallow lakes and ponds, Sediments and Micro-flora, Benthic animals and fish communities, Detritus – Organic carbon cycling and ecosystem Metabolism, Past productivity and Paleo-limnology, Ontogeny of Inland aquatic ecosystems, Understanding Inland water for the future.
Teaching learning Methods/Activities	Hands on training, learning in laboratory, oral presentation - individual / group assignments Lecture presentations, Tutorial discussions, Assignments [library, take home];Field studies and Reports, Laboratory Practical Records,
Evaluation/Assessment Strategy	**Theory:** In-course assessment(s): (30%) End of course examination: (70%) **Practical**: In-course assessment(s): (30%) End of course examination: (70%)
Recommended References	• Andrews, A. William [Ed.] A Guide to the study of Freshwater Ecology. Prentice-Hall of Canada Ltd. 1972 Chattopadhyay, G.N. Chemical Analysis of Fish pond soil and water, Daya publishing house, Delhi, 1998- 110035, Gopal, Brij and Wetzel, G. Robert, [Eds.]. Limnology in Developing Countries –Vol.1, International Association for Limnology, InternationalScientific Publications, New Delhi, India 1995Gopal, Brij,[Ed.].. Environmetal Flows –An Introduction for Water resources Managers, National Institute of Ecology, New Delhi, India.2013 • Wetzel G. Robert.. Limnology – Lake and River Ecosystems, Third Edition, Academic press – An Imprint of Elsevier,USA. 2001

Semester	First		
Title of the Course Unit	Endocrinology		
Course Code	ZOL 303M3		
Credit Value	3		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning
	27	39	84
Objective/s	Provide the knowledge on the coordinating system of animals through introducing the hormonal regulating systems of invertebrates and vertebrates and the applications		
Intended Learning Outcomes	• Describe hormonal regulating systems of invertebrates and vertebrates. • Compare the efficient of hormonal system in the evolutionary point. Justify the applications of endocrinology in captive breeding		
Contents	Structure and function of endocrine glands and organs in invertebrates and vertebrates; pituitary, thyroid, parathyroid, pancreas, gastrointestinal tract, adrenal gland, pineal gland, kidney, testis, ovary and endometrial tissue. Biochemistry, Biosynthesis and Biodegradation of endocrine and digestive hormones. Biochemical and physiological effects; Interrelations and applications of Pheromones; Mechanisms of hormone action; Growth, development, metabolism; homeostasis, Sex determination;. Applications of endocrinology.		
Teaching learning Methods/Activities	**Theory**: In-person lectures **Practical**: Hands on training, learning in laboratory, oral presentation - individual / group assignments		

Evaluation/Assessment Strategy	**Theory:** In-course assessment(s): (30%) End of course examination: (70%) **Practical**: In-course assessment(s): (30%) End of course examination: (70%)
Recommended References	• Bentley, Peter John. *Comparative vertebrate endocrinology*. Cambridge University Press, 1998. Kleine, Bernhard, and Winfried G. Rossmanith. *Hormones and the endocrine system*. Berlin: Springer, 2016. Melmed, Shlomo, et al. *Williams textbook of endocrinology*. Elsevier Health Sciences, 2015.

Title of the Course Unit	Molecular Biology and Immunology		
Course Code	ZOL 304M3		
Credit Value	3		
Prerequisites	ZOL302G2		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning
	27	39	84
Objective/s	• Impart knowledge on the advanced molecular biology principles and techniques in different fields of sciences • Illustrate the defensive mechanisms exist in animals		
Intended Learning Outcomes	• Describe the gene structure and function • Distinguish the gene expression among different classes of organisms • Differentiate extra chromosomal inheritance		

	• Illustrate the mutations and their effects • Analyze different molecular biology techniques and their applications • Describe the defensive mechanisms available in invertebrates and vertebrates • Understand the molecular pathways related to immune physiology • Demonstrate the recent advances in immunology • Analyze the immunological tools available in disease diagnosis
Contents	<u>Molecular Biology:</u> Enzymes and proteins involved in DNA replication and gene expression of prokaryotes and eukaryotes. The application of the mechanisms in various fields of science. Mutations in human and animals and related health concerns. DNA recombination and transposition.SNPs and transposable elements. Laboratory techniques in DNA and RNA based analysis and proteomics <u>Immunology:</u> Basic structure of the immune system; Development of the immune system, organs, cells and molecules of the immune system; Innate immunity; Acquired immunity; Humoral immunity; Cell mediated immunity; Antigen recognition, capture and presentation; Immunologic tolerance and autoimmunity; Congenital and acquired Immuno-deficiencies. Molecular pathways: Toll, IMD and JACK/STAT. Laboratory techniques commonly used in Immunology: Serum separation; Immuno-blotting: ELISA, Western Blotting, Immuno-fluorescence and Immuno-histochemistry; Isolation of antigen by Immuno-precipitation and affinity chromatography, Flow-cytometry and fluorescence-activated cell sorting, Blood grouping Immunological diagnosis – Example: Dengue
Teaching learning Methods/Activities	**Theory**: In-person lectures **Practical**: Hands on training, learning in laboratory, oral presentation - individual / group assignments

Evaluation/Assessment Strategy	**Theory:** In-course assessment(s): (30%) End of course examination: (70%) **Practical**: In-course assessment(s): (30%) End of course examination: (70%)
Recommended References	• Abbas, A.K., Lichtman, A, H. and Pillai, S.. Cellular and Molecular Immunology, 8th Edition. Elsevier Limited. 2015 • Male, D., Brostoff, J., Roth, D.B. and Roitt, I. Immunology, 7th Edition. Elsevier Limited. 2007 • Delves,PJ. S J Martin, DR Burton and IM Roitt. Roitt's Essential Immunology, 12th Edition. Wiley-Blackwell. 2011 • Brown, T.A. Genomes. 2nd edition. Oxford Wiley Press, UK. 2002 • Robert Shlief. Genetics and Molecular Biology. Second edition. Johnm Hopkins University Press, USA.1993

Title of the Course Unit	Pest Management		
Course Code	ZOL 305M3		
Credit Value	3		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning

	27	39	84
Objective/s	• Impart knowledge on pests of agricultural importance, pest population dynamics, application of different techniques to assess pest status, different pest management strategies and their merits and demerits, and development of IPM for selected crops.		
Intended Learning Outcomes	• Define terminologies used in describing pest status and pest management • Explain dynamics of pest populations during out breaks • Assess damage caused pest species , levels of threshold and injury • Plan pest management strategies • Analyze different pest management strategies and their advantages and limitations • Evaluate strategies used for integrated pest management of pests for selected crops		
Contents	Pests- Invertebrate and vertebrate pests; Classification- outbreaks, estimation of damages and losses; Determination of threshold and economic injury levels; Assessment of pest population; types of distribution and impact of changing climates; Pest monitoring and forecasting. Different pest management techniques - cultural, mechanical, , Biorational (semiochemicals, Phytochemicals, other interference methods)biological (*microbial, genetic- host plant resistance- parasitoids - predators*) and chemical methods – with their merits and demerits - development of integrated pest management strategy for selected pests		
Teaching learning Methods/Activities	**Theory**: In-person lectures **Practical**: Hands on training, learning in laboratory, oral presentation - individual / group assignments		

Evaluation/Assessment Strategy	**Theory:** **Theory:** In-course assessment(s): (30%) End of course examination: (70%) **Practical**: In-course assessment(s): (30%) End of course examination: (70%)
Recommended References	Dent, David. "Insect pest management. CAB International." *PARLATORIA BLANCHARDII* (1991). Pedigo, Larry P., and Marlin E. Rice. *Entomology and pest management*. Waveland Press, 2014. Higley, Leon G., and Larry P. Pedigo, eds. *Economic thresholds for integrated pest management*. Vol. 9. U of Nebraska Press, 1996.

Title of the Course Unit	Environmental Toxicology		
Course Code	ZOL 306M2		
Credit Value	2		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning
	20	24	54
Objective/s	• Provide students with an understanding of the problems associated with indiscriminative use of chemicals and their impacts on the environment and bring ethical awareness in relation to environmental problems.		
Intended Learning Outcomes	• Identify the sensitive points to toxic agents in animal body. • Discuss the major issues, concepts and subject areas in environmental toxicology. • Describe major environmental toxicants and their significance. • Outline the principles of risk assessment and management for toxicology		
Contents	Historical aspects of environmental toxicology, Acute toxicity, Chronic toxicity,Dose-response and principles of assessing toxicity, Bioaccumulation, Biomagnification,Toxicokinetics,		

	Toxicodynamics, Genotoxicity, Ecological impacts and risk assessment, Biomarkers, Biological monitoring, Biological indicators, Clean-up Strategies (focusing on bioremediation and biodegradation),Environmental ethics, Relevant national environmental laws and policies.
Teaching learning Methods/Activities	**Theory**: In-person lectures **Practical**: Hands on training, learning in laboratory, oral presentation - individual / group assignments
Evaluation/Assessment Strategy	**Theory:** In-course assessment(s): (30%) End of course examination: (70%) **Practical**: In-course assessment(s): (30%) End of course examination: (70%)
Recommended References	Walker, Colin Harold, R. M. Sibly, and David B. Peakall. *Principles of ecotoxicology*. CRC press, 2016. Shaw, I. and J. Chadwick. *Principles of Environmental Toxicology*. Taylor & Francis. Inc. 1998

Title of the Course Unit	Research Methodology and data analysis		
Course Code	ZOL 307M2		
Credit Value	2		
Hourly Breakdown	Theory	Practical and field visits	Independent Learning
	20	24	56
Objective/s	• Introduce fundamental concepts of research design, data collection, statistical and interpretative analysis, and focus on the ability to use research in Zoology.		
Intended Learning Outcomes	• Explain principles of Zoological research problems. • Describe different research methods and designs in Zoological studies. • Sketch accurate data collection methodology.		

	• Analyse, interpret and construct zoological data. • Describe the Intellectual Property, patent filing and the Technology Transfer. • Assemble and present data and results.
Contents	Research in Zoology - Purpose, Types and Characteristics - Process of Research -Formulation of objectives - Formulation of Hypotheses – Types of Hypotheses - Methods of testing Hypotheses – Research plan and its components – Methods of Research (Survey, Observation, case study, experimental, historical and comparative methods) -. Research methodology: Research design (CRD, RBD, LSD). • Descriptive treatment of sample data; introduction to elementary probability and distributions; estimation and hypothesis testing of means and proportions; • The chi-square distribution; simple and multiple regression and correlation; one-factor and two-factor analysis of variance; and use of statistical computer packages to analyze data from animal research. • Animal diversity indices and distribution analysis: bioinformatics. • Impact of Intellectual Property Protection on Innovation. • Technology Transfer and Intellectual Property Management. • Non-Disclosure Agreements, Materials Transfer Agreements, • Trademark Law and Practice, an International Perspective. The Potential Impact of University Technology-based Economic Development. • Patent Databases, searching and analysis-Introduction of NIPO service. • Problems in Biological research-ethical, legal, social and scientific issues.
Teaching learning Methods/Activities	Lecture presentation , tutorial discussion, take-home assignments, problem based learning
Evaluation/Assessment Strategy	**Theory:** In-course assessment(s): (30%) End of course examination: (70%)

Recommended References	Quinn, Gerry P., and Michael J. Keough. *Experimental design and data analysis for biologists*. Cambridge university press, 2002. Van Belle, Gerald, et al. *Biostatistics: a methodology for the health sciences*. Vol. 519. John Wiley & Sons, 2004.