Subject: Zoology (ZOOL)				
General				
	Course Units	**Status**	**Pre-requisite**	**Co-requisite**
Year 1 Sem 1	BIOL 11072 Evolution and Biogeography	C	A/ L Biology	
Year 1 Sem 2	ZOOL 12014 Animal Diversity	C	A/ L Biology	ZOOL 12022
	ZOOL 12022 Animal Diversity Laboratory	C	A/ L Biology	ZOOL 12014
	ZOOL 12032 Insects in relation to man	A		
	ZOOL 12042 Introduction to ornamental fish culture	A		
Year 2 Sem 1	ZOOL 21014 Animal Histology, Physiology and Developmental Biology	C	A/ L Biology	ZOOL 21022
	ZOOL 21022 Animal Histology, Physiology and Developmental Biology Laboratory	C	A/ L Biology	ZOOL 21014
Year 2 Sem 2	ZOOL 22064 Animal Ecology and Behaviour	C	BIOL 11072	ZOOL 22042
	ZOOL 22042 Animal Ecology Laboratory	C	A/ L Biology	ZOOL 22064
Year 3 Sem 1	PRPL 31012 Professional Placement	O	All ZOOL compulsory units offered in Levels 1 & 2	
	ZOOL 31013 Fisheries Biology and Management[2]	C[1]/O	A/L Biology	
	ZOOL 31023 Applied Entomology[2]	O*	ZOOL 12014	
Year 3 Sem 2	ZOOL 32033 Aquaculture[2]	C[1]/O	A/ L Biology	
	ZOOL 32043 Parasitology[2]	C[1]/O	ZOOL 12014	

* offered only for General Degree students

[1] Compulsory only for the Zoology (Special) students

[2] The student who wish to follow Zoology as a subject should follow all compulsory course units and at least **three** optional ZOOL course units offered in the Level 3.

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Level 1

Semester 1

Course code : **BIOL 11072**
Title : Evolution and Biogeography
Pre-requisite : G. C. E. A/L Biology

Learning outcomes :
At the end of this course, students will be able to demonstrate knowledge on basic evolutionary concepts and biogeography.

Course content:
Theories of origin of earth, origin and evolution of plants and animals, Mechanisms of evolution, Natural selection, Human evolution, Extinction of plants & animals, Speciation, Introduction to biogeography.

Method of teaching and learning : A combination of lectures and practicals.

Assessment : End of semester written examination.

Recommended reading :
1. Futuyma, D. J. (1998). Evolutionary Biology, Third edition, Sinauer Associates, Inc., Sunderland, Massachusetts, U.S.A.
2. Futuyma, D. J. (2006). Evolution, Third edition, Sinauer Associates, Inc., Sunderland, MA, U.S.A.
3. MacDonald, G.M 2003 Biogeography-space, time and life John Wiley and Sorns. 518 p

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Course code : **ZOOL 12014**
Title : Animal Diversity
Pre-requisite : G.C.E. (A/L) Biology
Co-requisite : ZOOL 12022

Learning outcomes:
At the end of this course, the student will be able to describe the diversity of form and function of animals and discuss their evolutionary trends.

Course content :
Introduction to animal kingdom; Classification of animals and principles of nomenclature of animals; Structural organization and diverse modes of life of the following groups of animals: Rhizopoda, Zoomastigina, Apicomplexa, Ciliophora, Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda, Rotifera, Annelida, Onycophora, Arthropoda, Mollusca, Echinodermata, Lophophorates, Hemichordata, Urochordata, Cephalochordata and Chordata; Evolutionary trends in different invertebrate and vertebrate groups; Adaptive radiation of different groups of vertebrates. Special emphasis will be given to Sri Lankan fauna wherever necessary.

Method of teaching and learning : A combination of lectures, tutorials, and discussions.

Assessment : Continuous assessment and end of the semester examination.

Recommended reading :

1. Study Guide for ZOOL 12014 Animal Diversity, Department of Zoology, University of Kelaniya.
2. Barnes, R.D. (1987). Invertebrate Zoology. Saunders College Publishers, Philadelphia.
3. Hickman C.P, Robert, L.S. and Hikman, F.M. (1988). Integrated Principles of Zoology. Times, Mirror-Mosby College Publishing, saint Louis.
4. Young, J.Z., (1983) Vertebrates. Oxford University Press, Oxford.
5. Kershan, D.A., (1983) Vertebrate diversity. University tutorial Press, London.
6. Hickman C.P, Robert, L.S. and Larson, A. (2000). Animal diversity McGraw-Hill, New York
7. Pechenik, J.A., (2000). Biology of the Invertebrates, McGraw-Hill, New York
8. Moyle, P.R. and Cech, J.J. (2000) Fishes – An Introduction to Ichthyology. Prentice Hall, New Jersey.
9. Stebbins R.C. and Cohen, N.W. (1995). A Natural History of Amphibians. Princeton University Press, New Jersey.

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Course code : **ZOOL 12022**
Title : Animal Diversity Laboratory
Pre-requisite : G.C.E. (A/L) Biology
Co-requisite : ZOOL 12014

Learning outcomes: At the end of this course, the student will be able to assign any animal encountered, to the Phylum, Class, Order and even to the genus, in some cases, by examining morphological characteristics and, appreciate the morphological and functional diversity within the taxa .

Course content:
Laboratory work on the diversity, structural organization and functional morphology of selected types of the following groups of animals: Rhizopoda, Zoomastigina, Apicomplexa, Ciliophora, Porifera, Cnidaria, Ctenophora, Rotifera, Platyhelminthes, Nematoda, Annelida, Onychophora, Arthropoda, Mollusca, Echinodermata, Lophophorates, Hemichordata, Urochordata, Cephalochordata and Chordata. Special emphasis will be given to Sri Lankan fauna.

Method of teaching and learning : Laboratory Studies.

Assessment : Continuous assessment and end of the semester examination.

Recommended reading:
1. Laboratory Manual for ZOOL 12022 - Animal Diversity Laboratory, Department of Zoology, University of Kelaniya.
2. Barnes, R.D. (1987). Invertebrate Zoology. Saunders College Publishers, Philadelphia.
3. Jordan, E.L. and Verma, P.S.(1995) Invertebrate Zoology.S. Chand & Company, NewDelhi.
4. Young, J.Z., (1981) Life of vertebrates. Oxford University Press, Oxford.
5. Dutta, S.K. and K. Mamamendra-Arachichi, (1996) The Amphibian Fauna of Sri Lanka. Wild life Heritage Trust of Sri Lanka, Colombo.
6. De Silva, P.H.D.H. (1980) Snakes of Sri Lanka. Department of Government Printing, Colombo
7. Pethiyagoda, R. (1991). Freshwater Fishes of Sri Lanka Wildlife Heritage Trust, Colombo.
8. Henry, G.M. (1978). A Guide to the birds of Ceylon. K.V.G. De Silva & Sons, Kandy.
9. Phillips, W.W.A. (1981). The Manual of Mammals of Sri Lanka. Volumes I-IV. Wildlife and Nature Protection Society of Sri Lanka, Colombo.
10. De Silva, Anslem (1990) A Colour Guide to the Snakes of Sri Lanka. Portishead Avon R. and A. Publication Limited.

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Course code : **ZOOL 12032**
Title : Insects in Relation to Man
Pre-requisite : NONE
Co-requisite : NONE

Learning outcomes:
At the end of this course, students will be able to demonstrate basic knowledge on insect biology, importance of insects in relation to agriculture, industry, health and natural environment and discuss insect pest management.

Course content:
Position of the insects in the animal kingdom and their general morphology, Identification of an insect, Habits and life cycles and selected physiological and behavioural characteristics of insects, Insects as a successful group of animals on earth, Role of insects in nature, beneficial insects and commercially valuable insect products, Use of insects for teaching and research, destructive insects, agricultural and stored product pests, role of insects in vector borne diseases, parasitic insects of livestock, insect pest control.

Method of teaching and learning : Lectures and tutorial discussions

Assessment: Continuous assessment and the end of semester examination.

Recommended reading:
1. F.G. Werner and C.E. Olson (1994) Learning about and Living with Insects of the Southwest. How to Identify Helpful and Venomous Insects. Fisher Books. ISBN 15556-10609
2. R.G. Davis (1998) Outlines of Entomology. Chapman and Hall, London.

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Course code : **ZOOL 12042**
Title : Introduction to Ornamental Fish Culture
Pre-requisite : None
Co-requisite : None

Learning outcomes:
By the end of this course, the student will be able to demonstrate basic knowledge on setting up and managing a home aquarium and a small scale ornamental fish culture system and, describe breeding, feeding and preventing/controlling common diseases of ornamental fish and transporting fish giving minimum possible stress.

Course content:
Fish as ornamental animals; water and the culture facility as their " life supporting" system; Popular tropical freshwater ornamental fin fish and plants; Setting up of an observation unit (home aquarium) with tropical freshwater fin fish; starting a small scale ornamental fish culture system; management of fish stocks and water quality; breeding of some popular tropical ornamental fish species; feeding of larvae, juveniles and broodstock; live feed and formulated feed; common diseases of ornamental fish; prevention and control of diseases; ornamental fish transport.

Method of teaching and learning:
A combination of lectures, laboratory studies, web-based studies and a field visit to a commercial ornamental fish farm.

Assessment: Continuous assessment and end of semester examination.

Recommended reading:
1. Mills, D. (1988) Popular guide to Tropical Aquarium Fishes. Salamander Books Limited, London.
2. Mills, D. (1992) Tropical Aquarium Fishes – How to keep Freshwater Fish. Chancellor Press, London.

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Course code : **ZOOL 21014**
Title : Animal Histology, Physiology and Developmental Biology
Pre-requisite : BIOL 11072
Co-requisite : ZOOL 21022

Learning outcomes: At the end of this course, the student will be able to describe and discuss tissue level of organization, and principles related to functioning and ontogenic development of animals with special reference to the human.

Course content :
Animal Histology: Main types of tissues and their origin: epithelial tissues; connective tissues; muscle tissues and nervous tissues, cell junctions, histology of selected organ systems of vertebrates with special reference to the human.
Animal Physiology: Homeostasis, propagation and transmission of signals, sensory mechanisms, muscle contraction, blood circulation, digestion and nutrition, immunity, exchange of gases, osmoregulation, excretion and hormonal co-ordination with special reference to the human.
Developmental Biology: Fertilization, cleavage, gastrulation, formation of primary organ rudiments, organogenesis; growth and differentiation, signal molecules that control development and growth; development of the human during pregnancy, prenatal diagnostic tests

Method of teaching and learning : A combination of lectures, tutorials, assignments and discussions.

Assessment : Continuous assessment and end of the semester examination.

Recommended reading :
1. Freeman, W.H. (1980). An Atlas of Histology, Heinemann Educational Book, London.
2. Tortora, G.J. and S.R. Grabowski (1996) Principles of Anatomy and Physiology. Harper Collins Publishers, New York
3. Eckert, R. (1988) Animal Physiology- Mechanism and Adaptations. W.H. Freeman Company, New York.
4. Muller W.A. (1997) Developmental Biology. Springer-Verlag, New York.
5. Balinsky B.E. (1981) An Introduction to Embryology, CBS College Publishing, New York.

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Course code : **ZOOL 21022**
Title : Animal Histology, Physiology and Developmental Biology Laboratory
Pre-requisite : G.C.E (A/L) Biology
Co-requisite : ZOOL 21014

Learning outcomes: At the end of the course, the student will be able to demonstrate

1. competence in recognizing histological structure and different stages of ontogenic development of selected animal groups.
2. essential skills required in studying animal function and functioning of animals.

Course content :
Laboratory studies on main types of animal tissues and histological structure of selected organ systems of animals with special reference to human, ontogenic development of selected animal groups.

Laboratory experiments on reflexes, vision, hearing and equilibrium, muscle contraction, cardiovascular physiology, respiration, endocrine organs and excretion.

Method of teaching and learning : Laboratory studies

Assessment : Continuous assessment and end of the semester examination.

Recommended reading :
1. Animal Physiology Laboratory manual for ZOOL 2212, University of Kelaniya
2. Freeman, W.H. (1980). An Atlas of Histology, Heinemann Educational Book, London.
3. Tortora, G.J. and Grabowski, S.R.(1996) Principles of Anatomy and Physiology. Harper Collins Publishers, New York
4. Eckert, R. (1988) Animal Physiology- Mechanism and Adaptations. W.H. Freeman Company,New York.
5. Muller W.A. (1997) Developmental Biology. Springer-Verlag, New York.
6. Balinsky B.E (1981) An Introduction to Embryology, CBS College Publishing, New York.

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Course Code : **ZOOL 22042**
Course Title : Animal Ecology Laboratory
Pre-requisite : G.C.E. (A/L) Biology
Co-requisite : ZOOL 22064

Learning Outcomes: By the end of this course the student will be able to demonstrate skills on the basic sampling techniques, gathering, analysis, interpretation and presentation of ecological data and information required for understanding ecosystem functioning.

Course content:
Sampling techniques for terrestrial, aerial, soil and aquatic animals; Study of soil ecosystems; Diversity indices; Estimation of the size of animal populations; Measurement of water quality; Limiting factors and effect of temperature on animals; Identification of animals in the brackishwater, freshwater and marine ecosystems and their ecological adaptations; Field studies on terrestrial, soil, freshwater, brackishwater and marine ecosystems.

Method of teaching and Learning:
A combination of laboratory and field studies and, web based learning.

Assessment:
Continuous assessment and end of the semester practical examination.

Recommended reading:
1. Krebs, C.J. (1999). Ecological Methodology, Addison-Welsey Educational Publishers, New York
2. Southwood, T.R.E. (1978). Ecological Methods; with particular reference to insect populations, 2nd edition, Chapman and Hall, London.
3. Chalmers, N. and Parker P. (1996). Fieldwork and Statistics for Ecological Projects, The OU Project Guide, London.
4. Enger, E.D. and Smith B.F. (2000). Field laboratory exercises in environmental sciences, 7th edition. McGraw-Hill, New Jersey.

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Course code : **ZOOL 22064**
Course Title : Animal Ecology and Behaviour
Pre-requisite : BIOL 11072
Co-requisite : ZOOL 22042

Learning Outcomes:
By the end of this course, students will be able to demonstrate knowledge on basic principles related to the structure and functioning of various types of ecosystems and explain basic behavioural patterns seen in animals.

Course content:
Principles related to the structure and functioning of ecosystems including energy flow and material cycling, Community composition, Niche and niche theory, Community interactions including predation and competition, Characteristics of populations, Fundamentals of the structure and functioning of terrestrial, freshwater, brackishwater and marine ecosystems.

Global environmental issues, Environmental impact assessment, Fundamentals of Geographical Information Systems (GIS) as a tool for environmental management.

Introduction to animal behaviour and basic behavioural patterns, Learning, Animal communication, Rhythms in animal behaviour, Sexual behaviour and parental care; Aggression; Motivation and drive; Social organization in higher vertebrates and Functions of behaviour.

Method of teaching and Learning:
A combination of lectures, tutorials and web-based studies.

Assessment: Continuous assessment and end of the semester examination.

Recommended reading:

1. Odum E.P. (1971). Fundamentals of Ecology. Saunders College Publishers, Philadelphia.
2. Tait R.V. and Dipper F.A. (2000). Elements of marine ecology. Butterworth-Heinemann, Oxford.
3. McLusky D.S. (1971). Ecology of estuaries. Heinemann Educational, London.
4. Krebs C.J. (1985). Ecology. Harper and Row Publishers, New York.
5. Wetzel R.G. (2001). Limnology. Academic Press, London.
6. Begon M., Harper J.L. and Townsend C.R. (1986). Ecology; Individuals, Populations and communities. Blackwell Science, Oxford.
7. Manning A., and Dawkins M.S. (1995). An Introduction to Animal Behaviour, Cambridge University Press, Cambridge.
8. Keeton W.T. and Gould J.L. (1993). Biological Science 5th edition. W. W. Norton and company, New York.
9. Chapman J.L. and Reiss M.J. (1997). Ecology, Cambridge University Press, Cambridge.
10. Current information on the Internet.

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Course code : **ZOOL 31013**
Title : Fisheries Biology and Management
Pre-requisite : G.C.E. (A/L) Biology

Learning outcomes:
At the end of this course, the students will be able to describe characteristics of world fisheries, status of the fisheries of Sri Lanka and major aspects of fish biology relevant to fisheries and, discuss basic aspects of fish population dynamics, stock assessment and fisheries management.

Course content :
Characteristics of fisheries, world fisheries, fisheries of Sri Lanka, Fishing gear and methods, common edible fish species of Sri Lanka, exotic species, ornamental fish species, morphometric and meristic studies of fish, food and feeding of fish, fish morphology in relation to food and feeding habits, reproductive biology, fisheries and aquatic pollution, fisheries enhancement, basic aspects of fish population dynamics and stock assessment, basic principles of fisheries management.

Method of teaching and learning : A combination of lectures, field studies and laboratory studies.

Assessment : Assessment of field and laboratory reports and the end of semester theory and practical examinations.

Recommended reading :

1. King, M. (1995), Fisheries Biology, Assessment and Management, Fishing News Books, Oxford.
2. Pitcher, T.J. and Hart, P.J.B. (1982), Fisheries Ecology, Croom Helm, London.
3. Pauly, D. (1984) Fish Population Dynamics in Tropical Waters: A manual for use with programmable calculators, ICLARM, Manila.

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Course code : **ZOOL 31023**
Title : Applied Entomology
Pre-requisite : ZOOL 12014

Learning outcomes: At the end of this course, the students will be able to

1. identify common insect and mite pests that are of agricultural, medical and veterinary importance in Sri Lanka and describe their biology
2. describe damages and damage symptoms caused by insect & mite species that are economically important in Sri Lanka.
3. demonstrate skills in procedures and techniques for studying insect and mite biology.
4. recommend suitable measures for the management of insect and mite pests.

Course content :
Introduction to the orders of common insect pests and Order Acarina, Biology and control of insect and mite pests of rice, coconut, tea, sugarcane and selected fruit and vegetable crops in Sri Lanka, Biology and control of stored product pests, Causes of insect pest outbreaks, Concepts in insect pest management; General Equilibrium Level, Economic Threshold Level and Economic injury Level, Chemical, cultural and biological control of insect pests, Integrated pest management, Biology and control of household insect pests that are of medical and veterinary importance in Sri Lanka.

Demonstrations on life stages and damage symptoms of economically important insect and mite pests of rice, coconut , tea, sugarcane, selected fruit and vegetable crops and stored products, Techniques for preservation, mounting and permanent slide preparation of insects, Use of insect taxonomic keys for the identification of insect pests to the order and genus levels (ants and aphids), Natural enemies of insect and mite pests, Insecticides and application equipment, Biological control programmes in Sri Lanka, Insect rearing methods, Demonstrations on life stages of household insect pests that are of medical and veterinary importance in Sri Lanka.

Method of teaching and learning : A combination of lectures, tutorials, laboratory work, case studies and field visits

Assessment : Continuous assessment and end of the semester (theory and practical) examinations.

Recommended reading :
1. Hill, D.S.(1979) Agricultural insects pests of the tropics and their control. Cambridge University Press, Cambridge
2. Atwal, A. S. and Dhaliwal, G.S. (1997) Agricultural pests of South Asia and their management. Kalyani Publishers, New Delhi.
3. Kettle, D.S. (1997) Medical and veterinary entomology. Oxford University Press, Oxford

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Course code : **ZOOL 32033**
Title : Aquaculture
Pre-requisite : G.C.E. (A/L) Biology

Learning outcomes:
At the end of this course, students will be able to

1. demonstrate a sound knowledge on principles of aquaculture, aquaculture systems, breeding, feeding and diseases of cultured fish.
2. identify common edible fin fish and shellfish species used in tropical freshwater, brackishwater and marine aquaculture and common tropical freshwater and brackishwater ornamental fish species.
3. demonstrate skills in applying the knowledge gained in practicing aquaculture

Course content:
Aquaculture systems, desirable features of potential species for aquaculture, site selection for land based and water based aquaculture, different aquaculture facilities, freshwater edible fin fish culture, ornamental fish culture with compatible aquarium plants, brackishwater shrimp culture and fin fish culture, mariculture of edible fin fish and molluscs. Breeding of selected species of edible and ornamental fin fish and shrimp, provision of food for different developmental stages of shrimp and for some selected fin fish species; Common viral, bacterial, fungal and parasitic diseases of fin fish and shrimp recorded in tropical aquaculture.

Method of teaching and learning :
A combination of lectures , tutorials, assignments, laboratory studies and field studies.

Assessment: Continuous assessment, assessment of field study reports/ presentations related to field studies and end of semester practical and theory examinations.

Recommended reading:
1. Bardach, J.E. et.al. (1972) Aquaculture : The farming and husbandry of freshwater and marine organisms. John Wiley & Sons, New York.

2. Pillay, T.V.R. (1990) Aquaculture: Principles and Practice. Fishing New Books, Oxford.

3. Mills, D. (1988). Popular guide to tropical aquarium fishes. Salamander Books Limited, London.

4. Noga, E.J. (2000) Fish Diseases: Diagnosis and treatment. Blackwell Science, Oxford.

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Course code : **ZOOL 32043**
Title : Parasitology
Pre-requisite : ZOOL 12014

Learning outcomes: At the end of this course the student will be able to:

1. describe biology of important parasites of man, domestic animals and fish and discuss epidemiology and management of the parasites.

2. describe biology and discuss integrated management of plant parasitic nematodes that are economically important in Sri Lanka.

3. demonstrate practical skills relevant to identification of parasites of man, domestic animals and fish; identification and management of plant nematodes that are economically important in Sri Lanka.

Course content:
Introduction to parasitology, morphology, biology and life cycles of important parasites of man, domestic animals and fish; pathogenesis, symptoms, transmission and prevention of parasitic infections caused by parasitic protozoans, flukes, tapeworms and parasitic nematodes. Morphology, identification and life cycles of important plant parasitic nematodes; economic threshold level; important nematode parasites of tea, rice and selected crops in Sri Lanka and their management.
Parasitic survey for liver and gastro-intestinal parasites of cattle and rat, parasitic survey of fish; soil sampling for population studies of parasitic nematodes, extraction of nematodes from soil and plant materials.

Method of teaching and learning: A combination of lectures, tutorials, assignments, discussions and laboratory studies.

Assessment: Continuous assessment and end of the semester practical and theory examinations.

Recommended reading:

1. Schmidth, G.D. and Roberte, L.S. (2000): Foundations of Parasitology 6th Edition, Mc-Graw Hill. New York.
2. Nickle, W.R. (1991): Manual of Agricultural Nematology, Marcel Dekker Inc., New York.
3. Luc,M., Sikora, R.A. and Bridge, J. (1993): Plant Parasitic Nematodes in Subtropical and Tropical Agriculture, CAB International, Wallingford, UK.
4. Noga, E.J. (2000). Fish Diseases: Diagnosis and Treatment, Blackwell Science, Oxford.
5. Axelrod, H.R. (1989): Handbook of Fish Diseases. T.F.H.Publications, Oxford

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