

## ZOOLOGY (ZL) COURSES

### ZL 121 INVERTEBRATE ZOOLOGY

2

#### UNITS

##### Objectives:

At the end students should be able to:

Describe and explain the basic principles of animal classification, form and function among invertebrate phyla.

Identify and classify the main groups of invertebrates

Describe the main elements of the biology and evolutionary relationships of the major groups of invertebrates.

##### Content:

Classification of animals: basic structure and functional features of the Protozoa, Porifera, Radiata, Acoelomata, Pseudo-coelomata. Annelida, Arthropoda, Mollusca and Echinodermata.

Evolutionary relationships among invertebrate phyla.

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Course work 40%; Final examination 60%.

##### Textbooks:

1. Ruppert, E.E. and R.D. Barnes 1994 Invertebrate Zoology. Saunders
2. Pechenik, J.A. 1999. Biology of Invertebrates (4th Ed). MacGraw-Hill Higher Education Publishing Co

##### References:

1. Barrington, E.J.W. 1974. Invertebrate Structure and Function. ELBS.
2. Brusca, R.C. and G.J. Brusca 1990. Invertebrates. Sinauer Associates Inc.
4. Wallace, R.L. and K.T. Walter 1996 Invertebrate Zoology: A Laboratory Manual. Prentice Hall.

### ZL 122 CHORDATE ZOOLOGY

2

#### UNITS

##### Objectives:

At the end students should be able to:

Describe and explain the basic biology, evolution and classification of vertebrates and the other forms. Students will be introduced to the array of Chordates which include not only the vertebrates, but also a number of other less familiar forms.

Identify the main groups of the Chordata and describe the main elements of their biology and their evolutionary relationships.

##### Content:

The chordate plan, its establishment and elaboration as exemplified by the lower chordates.

Adaptability of the plan to the higher chordates. A study of the evolution of the vertebrate classes, Cyclostomata, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves and Mammalia, emphasising the major structural and functional features of each class.

**Delivery:** 15 hours of lectures, 45 hours of practicals.

**Assessment:** Course work 40%; Final examination 60%.

##### Textbooks:

Young, J.Z. 1981 The Life of Vertebrates (3<sup>rd</sup> Ed). Oxford University Press, Oxford  
Evolution of vertebrates by Edwin H. Colbert, Wiley Eastern Ltd, New Delhi. ISBN 085226125X

## **ZL 124 DEVELOPMENTAL BIOLOGY**

### **UNITS**

**2**

#### **Objectives:**

At the end students should be able:

To describe the early stages of animal development from gametogenesis to morphogenesis.

#### **Content:**

Classical concepts of embryology. Gametogenesis: origin of germ cells; spermatogenesis; oogenesis; vitellogenesis. Sperm-egg encounter and penetration. Changes following fertilisation; cleavage, gastrulation, neurulation and morphogenesis. Mechanism of cellular differentiation; Embryonic induction during differentiation and organogenesis. Metamorphosis; Teratology. A comparative study of development in several vertebrate classes.

**Delivery:** 15 hours of lectures and 45 hours of practicals.

**Assessment:** Course work 40%; Final examination 60%.

#### **Text book:**

Gilbert, S. F. 2005 Developmental Biology (8<sup>th</sup> Ed). Sinauer Associates, Sunderland M.A

#### **References:**

1. Tyler, M.S. 1994 Developmental Biology. A Guide for Experimental Study. Sinauer, Associates, Sunderland M. A.
2. O’Rahilly R.R. and Muller F. 2001. Human Embryology & Teratology. 3<sup>rd</sup> edition. Willey ISBN: 0-471-38225-
3. Schoenwolf, Gary C. 2007 Atlas of Descriptive Embryology, Addison- Wesley
4. Muller, Werner 1997 Developmental Biology . Springer

## **ZL 202: MACRO EVOLUTION**

### **UNITS**

**3**

#### **Objectives:**

At the end of the course students should be:

To illustrate different methods of acquiring past evolutionary information.

To describe the epochal history and phylogenies of major invertebrate and chordate taxa.

To place biological evolution in the context of the other evolutions in the social, terrestrial, chemical and astronomical areas.

#### **Content:**

Fossil dating using <sup>3</sup>H, <sup>14</sup>C, K/Ar, thermoluminescence, optically stimulated luminescence. Geologic time scale. The cladistic classification method. Phylogenies of bilateria, Acoelomate Spiralia, Coelomate Protostomes, Deuterostome. Case studies in invertebrate evolution chosen among Mollusca, Arthropoda, Echinodermata. Evolution of major chordates: Ostracoderms to modern fish; amphibian access to land; reptile cleidoicism and the feathered birds; non-primate placentals. Prosimian and anthropoidean families. Human evolution through Ardipithecine, Paranthropine, Australopithecine into Hominine species. Universality of evolution seen in the context of the social, chemical, terrestrial and astronomical evolutions.

**Delivery:** 15 hours of lectures and 45 hours practicals.

**Assessment:** Course work 40%; Final examination, 60%.

**Text books:**

1. Campbell BG and Loy JD 2000. Humankind emerging (8<sup>th</sup> edn). Allyn and Bacon.

**References:**

1. Haviland WA 1999. Human evolution and Prehistory. Wadsworth Publishing.
2. Levinton JS 2001. Genetics, Palaeontology and Microevolution. Cambridge University Press.
3. Skelton P. *et al.* 2002. A practical primer into cladistics. Cambridge University Press.

**ZL 206 MOLLUSCAN BIOLOGY  
UNITS**

**2**

**Objectives:**

At the end students should be able:

To describe the diversity of terrestrial, fresh water and marine Molluscs, their functional organisation, and adaptive radiation.

To distinguish molluscs of academic, agricultural, medical and economic importance.

**Content:**

Overview of molluscan systematics. Body structure and function of representative monoplacophora, polyplacophora, scaphopoda, and pelecypoda. Functional organisation and adaptive radiation among aquatic and terrestrial prosobranchs, opisthobranchs, pulmonates and cephalopods. Species diversity in land, freshwater and marine molluscs. Medical and economic malacology. Bioculture of important molluscan groups. Evolutionary contributions of the shell makers.

**Delivery:** 15 hours of lectures and 45 hours of practicals.

**Assessment:** Course work 40%; Final examination 60%

**Text books:**

Brown, D.S. 1980 Freshwater Snails of Africa and their Medical Importance. Taylor & Francis Ltd

Malek, E.A. and T.C. Cheng 1990 Medical and Economic Malacology (2<sup>nd</sup> Ed). Academic Press

**Reference:**

Dales, R.P. (Ed) 1981 Practical Invertebrate Zoology. Blackwell Scientific Publications. Oxford.

Purchon, R.D. 1997 The Biology of the Mollusca (3<sup>rd</sup> Ed). Pergamon Press.

Seddon M.B. Tattersfield and B. Ruparelia 1996 Manual for Research on Molluscan Biodiversity Conservation. National Museums of Wales, Cardiff.

Solem, R.D. 1994 The Shell Makers. Academic Press.

**ZL 207 ICHTHYOLOGY  
UNITS**

**2**

**Objectives:**

At the end of the course students should be able:

To distinguish the major groups of fish, understand their phylogeny and biology.

To describe different techniques for management and conservation of fish as a resource.

**Content:**

Fish classification and phylogeny. Major groups of fishes. Basic fish anatomy and physiology: respiration, reproduction, osmoregulation, buoyancy, locomotion, growth and feeding. Zoogeography. Fishes of economic importance in East Africa.

**Delivery:** 15 lectures and 45 hours of practicals

**Assessment:** Course work 40%; final examination 60%.

**Text books:**

Lagler, K. F., J.E. Bardach, R.R. Miller and D.R.M. Passino 1977 *Ichthyology* (2<sup>nd</sup> Ed). John Wiley & Sons, Inc. New York

Moyle, P. B. and J.J. Cech Jr. 1988 *Fishes*. Academic Press, USA

**References:**

Bond, C. C. 1979 *Biology of Fishes*. Saunders College Publishing, USA.

Lowe-McConnell, R. H. 1987 *Ecological Studies in Tropical Fish Communities*. Cambridge University Press, Cambridge..

Smith, L. S. 1982 *Introduction to Fish Physiology*. T. F. H. Publications, Inc. New Jersey.

**ZL 210 VERTEBRATE ANATOMY AND PHYSIOLOGY I  
UNITS****2**

*Prerequisites: ZL121 and ZL122*

**Objectives:**

At the end students should be able:

To describe the basic structure and systems of the vertebrate body.

To explain how the various systems function and interact in the body and how they are adapted to the animal's ecosystem

**Content:**

Structure and function of vertebrate tissues and organ systems: The integument: dermal and epidermal derivatives. Skeletal tissue, cranial and post-cranial skeletons. Smooth, skeletal and cardiac muscles. Mechanisms of muscle contraction. Nerve cells, regional anatomy and physiology of the brain and spinal cord. Structure and function of the sense organs. Endocrine system: the pituitary, thyroid, parathyroids, adrenal glands and pancreatic islets. Hormones of pancreatic islets

**Delivery:** 15 hours of lectures and 45 hours of practicals.

**Assessment:** Coursework 50%; Final examination 50%.

**Textbooks:**

Burggen W.W., French, K., Eckert R. and D. Randall 2001. Eckert Animal Physiology. Mechanism and Adaptations. W.H. Freeman

Burkitt, H.G., B. Young, and J.W. Heath 1993 Wheater's Functional Histology. (3<sup>rd</sup> Ed). Longman Group Ltd

Kent, G.C.1983 Comparative Anatomy of Vertebrates. Publisher Mosby Year Book

**References:**

- Campbell, N.A.,J.B. Reece L.G.Mitchell and M.R.Taylor 2003. Biology: Concepts and Connections (4<sup>th</sup>Ed.) Benjamin/Cummings Publishing Company.  
Schmidt-Nielsen, K.2001 Animal Physiology:Adaptation and environment (5<sup>th</sup> Ed). Cambridge University Press.  
Romer, A.S. and T.S. Parsons 1986 The Vertebrate Body (6<sup>th</sup> Ed). Longman Group Limited.  
Bloom, M.D. and D.W. Fawcett 1975 A textbook of Histology (10<sup>th</sup> Ed). W.B.Saunders Company.  
Eckert,R & G. Augustine 1988 Animal Physiology. Mechanism and Adaptations 3<sup>rd</sup> Ed W. H. Freeman  
Martini, F.H. 2006 Fundamentals of Anatomy and Physiology (4<sup>th</sup> Ed) Prentice-Hall Inc

**ZL 214 HERPETOLOGY**

**2**

**UNITS**

**Objectives:**

At the end of the course students should be able:

To describe the biology of amphibians and reptiles, especially the classification, evolution, biology, ecology, conservation and management of the East African herpetofauna.

To describe, classify and identify the common and endemic amphibians and reptiles of Tanzania.

**Content:**

An introduction to herpetology, with emphasis on the East African amphibians and reptiles; an overview of the history and literature of herpetology; speciation in herptiles; general amphibian and reptile structure, biology, ecology and evolution; Techniques for the study of herptiles, including baseline surveys; the commercial and other values attached to herptiles; the management and conservation of East Africa's herptile fauna. Practical classes will emphasise the recognition of East African species. Students will be expected to use the appropriate search engines on the world wide web when conducting literature searches for written assignments as well as to supplement information provided in lecture.

**Delivery:** 15 hours of lectures and 45 hours of practicals.

**Assessment:** Course work 40%; Final examination 60%

**Textbooks:**

- Goin, C.J., Goin, O.B. & Zug, G.R. (1977) Introduction to Herpetology. W.H. Freeman & Company. San Fransisco.  
Pough, F.H., Andrews, R.M., Cadle, J.E., Savitsky, A.H. & Wells, K.D. (2000) *Herpetology*. Prentice Hall. New York.

**References:**

- Spawls, S.S., K.M. Howell, R.C. Drewes & J. Ashe 2000 A Field Guide to the Reptiles of East Africa. Academic Press, London.  
Spawls, S.S., K.M. Howell & Drewes, R.C. 2006 A Pocket Guide to the Reptiles and Amphibians of East Africa. A&C Black, London.  
Channing, A.C. & Howell, K.M. 2006 Amphibians of East Africa. Cornell Univ. Press, Ithaca  
Porter, K.R. (1972) Herpetology. W.B. Saunders Company. Philadelphia.

**ZL 215: MAMMALIAN BIOLOGY  
UNITS**

**2**

*Prerequisites: ZL122*

**Objectives:**

At the end students should be:

To describe the mammalian evolution, classification, basic biology, ecology and general behaviour, especially the East African mammal fauna.

To identify mammals, the common, as well as the cryptic and rare species, of Tanzania and East Africa.

**Content:**

An introduction to the origins, evolution and classification of mammals, with emphasis on the East African mammal fauna. Mammalian biology: basic morphology, physiology, ecology, behaviour and reproduction in selected families. Field techniques of trapping, specimen preparation and mammalian identification. The economic importance of mammals and their conservation.

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Course work 40%; Final examination 60%.

**Text books:**

Kingdon, J. 1997 The Kingdon Field Guide to African mammals. Academic Press, London.

Vaughan, T.A. 1985 Mammalogy (3<sup>rd</sup> Ed). Harcourt Brace Jovanovich College Publishers, London

**ZL 220 VERTEBRATE ANATOMY AND PHYSIOLOGY II  
UNITS**

**3**

*Prerequisites: ZL121, ZL122, & ZL 210*

**Objectives:**

At the end the students should be:

To describe the basic structure of vertebrate body and how the various systems function and interact in the body and how they are adapted to the animal's ecosystem.

**Content:**

Structure and function of the gut, digestive enzymes and gastro-intestinal hormones. Enzyme kinetics. Intermediate metabolism. Respiratory membranes. Ventilation mechanisms of respiratory organs. Functional adaptation of unique respiratory mechanisms. Respiratory pigments. Structure and function of the blood, heart, arterial and venous systems. Capillary blood flow. Lymphatic circulation. Structure and types of kidneys; urinary bladder. Extra-renal glands. Physiology of excretion and osmo-ionic regulation. Structure of gonads, reproductive ducts and accessory reproductive glands. Hormonal control of gonads. Metabolic heat, temperature regulation and adaptation

**Delivery:** 30 hours of lectures and 45 hours of practicals.

**Assessment:** Coursework 50 %; Final examination 50%.

**Textbooks:**

Burggen W.W., French, K., Eckert R. and D. Randall 2001. Eckert Animal Physiology. Mechanism and Adaptations. W.H. Freeman

Kent, G.C. 1983 Comparative Anatomy of Vertebrates. Publisher Mosby Year Book

Burkitt, H.G, B. Young, and J.W. Heath 1993 Wheater's Functional Histology: A Text and Colour Atlas (3<sup>rd</sup> Ed). Longman Group Ltd

**Reference:**

Campbell, N.A.,J.B. Reece L.G.Mitchell and M.R.Taylor 2003. Biology: Concepts and Connections (4<sup>th</sup>Ed.) Benjamin/Cummings Publishing Company.  
Schmidt-Nielsen, K. 2001 Animal Physiology: Adaptation and Environment (.5<sup>th</sup> Ed). Cambridge University Press.  
Romer, A.S. and T.S. Parsons 1986 The Vertebrate Body (6<sup>th</sup> Ed). Longman Group Limited.  
Martini, F.H. 2006 Fundamentals of Anatomy and Physiology (4<sup>th</sup> Ed.) Prentice Hall International. Inc.

**ZL 236 INTRODUCTORY ENTOMOLOGY & PARASITOLOGY**

**3 UNITS**

*Prerequisites: ZL121*

**Objectives:**

At the end students should be able:

To describe the general biology of insects and classification with emphasis on insects of economic and medical importance.

To identify the major groups of insects, conversant with the basic elements of their biology, their ecological and economic importance and the principles of pests and disease vector management.

Describe the main elements of the morphology, biology and patterns of their life cycles of the common parasites of medical and veterinary importance, and have an appreciation of the ways in which hosts and parasites interact.

**Content:**

*Classification of the Insecta. Insect morphology, anatomy and physiology. Insect development, ecology and behaviour. Dispersal and migration. Social life of insects; Biology of insects of medical, agricultural, forestry and veterinary importance. Insects as vectors of animal and human diseases. Concepts in parasitism. Parasitism as a lifestyle, origins, adaptations and diversity of parasites. Morphology, life cycles and importance of major disease causing parasites.*

**Delivery:** 15 hours of lectures and 45 hours of practical.

**Assessment:** Course work 40%, and Final examination 60%.

**Textbooks:**

Cedric Gillott. 2005 Entomology 3<sup>rd</sup> Edition

Richards, O.W. and R.G. Davies 1977 Imm's General Textbook of Entomology. Vols. 1 & 2. John Wiley and Sons, New York

Roberts, L.S. and J. Janovy Jr. 2000. Gerald D. Schmidt & Larry S. Roberts' Foundations of Parasitology (6th Ed). McGraw Hill. New York.

4. J. D. Smyth 1994. Introduction to Animal Parasitology. Cambridge University Press. Cambridge;

**References:**

.Scholtz, C.H. & E. Holm 1996 Insects of Southern Africa. University of Pretoria, Pretoria  
Chapman, R.F. 1998. The Insects: Structure and Function. Hodder and Stoughton. London.  
Neuman I.D. 1994 Systematic and Applied Entomology. An Introduction. Melbourne University Press. Melbourne.  
Wigglesworth V.B. 1984 The Principles of Insect Physiology (7<sup>th</sup> Ed). Chapman and Hall, London  
5. Bush, A.O., Fernandez, J.C., Esch, G.W. and J.R. Seed 2001. Parasitism: The diversity and

ecology of animal parasites. Cambridge University Press.

6. Esch, G.W. and J.C. Fernández 1993. A Functional Biology of Parasitism: Ecological and Evolutionary Implications. Chapman & Hall. London.

## **ZL 229 INSECT PHYSIOLOGY & PATHOLOGY**

### **UNITS<sup>1</sup>**

**2**

*Prerequisites: ZL 121, ZL 226*

#### **Objective:**

To enable students gain an understanding of the theoretical and practical aspects of Insect physiology.

Content: Nutrition (the insect alimentary system, food tips, digestion and assimilation. Insect's symbiotic micro-organisms and their role in Insect nutrition). Reproduction, excretion and osmoregulation, growth, metamorphosis and endocrinology. Insect sensory physiology. Focus will be on the physiological functions of the three body tagmata of the insect, namely head, thorax and abdomen i.e. head charged with feeding (food ingestion, alimentary canal), sensory functions (eyes, ocelli, tactile senses of the palps, antennae etc.), brain, ganglia, endocrine system etc.; thorax, locomotory, sound organs, modification of various appendages for different functions, flight muscles, respiratory system; abdomen, reproductive functions etc...; the cuticle as a separate system, moulting, growth, locomotion limitations, water conservation etc.

**Delivery:** 15 Hours of lectures, and 45 hours of practicals

**Assessment:** Course work 40%; Final examination 60%.

#### **Textbooks:**

1. Richards, O.W. and Davies, R.G 1977. Imms' General Textbook of Entomology, Tenth Edition.  
Volume One. Chapman & Hall, London
2. Wigglesworth V.B. 1984 The Principles of Insect Physiology (7<sup>th</sup> Ed). Chapman and Hall, London

#### **References:**

1. Boucias, D.G. and Pendland, J.C. 1998 Principles of Insect Pathology. Kluwer Academic Publishers.
2. Kaya, H.K. and Tanada, Y. 1992 Insect Pathology. Academic Press.
3. Lacey, L.A. 1997. Manual of Techniques in Insect Pathology. Academic Press.

## **ZL 230 INTRODUCTION TO ARACHNOLOGY**

### **UNITS<sup>2</sup>**

**3**

*Prerequisite: ZL 121, ZL 226*

#### **Objective:**

At the end of the course students should be able:

To explain the biology and importance of spiders, mites and ticks in the ecosystem, and as pests and disease vectors.

---

<sup>1</sup> New course

<sup>2</sup> New course

**Content:** Taxonomy of the Arachnida; morphology and biology of spiders; morphology and biology of mites and ticks; anatomy and physiology of arachnids; development and growth; general habits and behaviour (bionomics and ethology); role played by arachnids in the environment, in agriculture and in transmission of diseases to Man, livestock and wildlife; practical arachnology (collection, preservation, and identification; rearing, dissection etc. of arachnids). Ecology of ticks and mites, economic importance, control (difficulties associated with tick and mite control in relation to resistance (in relation to one-host, two-host or multiple-host tick relations) survival in the environment, fecundity etc.)

**Delivery:** 30 Hours of lectures, and 45 hours of practicals

**Assessment:** Course work 40%; Final examination 60%.

**Textbooks:**

1. Savoy, T. 1977. Arachnida 2nd Edition. Academic Press, London etc.
2. Baker, E.W. and Wharton, G.W. 1952. An introduction to Acarology. Macmillan Company, New York.

**References:**

1. Arthur, D.R. 1962. Ticks and disease. Pergamon Press, Oxford.
2. Dippenaar-Schoeman, A.S. & Jocqué, R. 1997 African Spiders An Identification Manual. PPRI, S. Africa
3. Filmer, F. 1992. Southern African Spiders: An Identification Guide. Struik, South Africa.
4. Wise, D.H. 1994. Spiders in ecological webs. Cambridge University Press, Cambridge. Yeoman,
5. G.H. and Walker, J.B. 1967. The ixodiid ticks of Tanzania: A study of the zoogeography of the Ixodidae of an East African country. Commonwealth Institute of Entomology, London.

**ZL 300 PRACTICAL TRAINING**

**2**

**UNITS\***

**Objective :**

At the end of the course students should be able:

To combine theory learned in class and skills and experience gained during practical training to solve practical issues in applied zoology.

To plan field surveys/activities, collect and analyse data, interpret and write a scientific report.

**Content:** Biology and Ecology of invertebrates (particularly arthropods, parasites etc.); Planning and carrying out a survey of insects of medical / economic importance e.g. mosquitoes, parasites of animals (including fish, frogs, small mammals etc); assessment and analysis of environmental degradation, water/soil contamination, assessment and analysis of animal response to stressful conditions etc. Plan and carry out a mini-project

**Delivery:** 6-8 weeks comprising of lectures, excursions and field work.

**Assessment:** Attendance (10%); Field data book (15%); Laboratory log book (15%) (Field and laboratory log books to be examined everyday); Final Report (60%)

**ZL 302 EVOLUTION**

**2**

**UNITS**

**Objectives:**

At the end of the course students should be able:

To describe the theories, mechanisms, processes and types of evolution in the plant and animal kingdom.

To describe the origin of the various animal groups, their adaptive equilibria and monitor progress towards genetic/taxonomic extinction or fixation.

To devise models of evolutionary processes and carry out predictive simulations. .

**Content:**

Universality of evolution. Genetic basis of organic evolution. Intra-species variation and polymorphism and their sustenance in populations. Hardy-Weinberg equilibria and conditions for zero evolution. Random drift, migration, gene flow and mutation pressure. Modes and coefficients of selection under dominant, co-dominant, sex-linked and multiple allelic systems. Use of computer models to simulate evolutionary processes. Natural selection and neutralism. Micro-evolution: isolating mechanisms, population differentiation and speciation. Macro-evolution: features, process and consequences. Evolution of major vertebrate taxa including the fishes, amphibians, reptiles, birds and primates.

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Course work 40%; final examination 60%

**Text books:**

1. Hanson E.D. 1998 Understanding Evolution (3<sup>rd</sup> Ed). Oxford University Press

**References:**

Futuyama, D. 1996 Evolutionary Biology. Sinauer Associates, New York.

Mayr, E 1986 Evolution and the Diversty of Life. Belknap Press. Harvard.

Strickberger, M. 1998 Genetics (4<sup>th</sup> Ed). Sinauer Associates.

**ZL 307 ANIMAL BEHAVIOUR I  
UNITS**

**2**

**Objectives:**

At the end of the course students should be able:

To explain the animal behaviour (micro to macro levels), its mechanisms, causes, development, function and evolution.

To explain different techniques used in handling wild and captive animals and when each or combined techniques can be applied.

**Content:**

**Description and classification of behaviour; reception, transmission and processing of stimuli; simple and complex behaviour. Sensory processes and communication. Instinct learning and motivation. Social behaviour. Conflict behaviour and orientation. Evolution and development of behaviour. Behavioural aspects of selected animals. Animal behaviour and humans.**

**Delivery:** 15 lectures and 45 hours of practicals.

**Assessment:** Course work 40%; final examination 60%.

**Textbooks:**

Alcock, J. 2005 Animal Behaviour: An Evolutionary Approach 9<sup>th</sup> Ed Sinauer Associates, Inc. Publishers. Sunderland, Mass.

Clark, D. and Boutros, N. 2000 Brain and Behaviour: An Introduction to Behavioural Anatomy. Blackwell Science, Oxford.

Manning, A. and M.S. Dawkins 1992 *An Introduction to Animal Behaviour*. Cambridge University Press. Cambridge

**References:**

Drickamer Lee C, Stephen H.V and Elizabeth J 2001 *Animal Behaviour: Mechanisms Ecology and Evolution*. McGraw-Hill Science

Schmidt-Nielsen, K. 2001 *Animal Physiology. Adaptation and Environment*. Cambridge University Press

Krebs J. R. and N. B. Davies 1993 *An Introduction to Behavioural Ecology*. Blackwell Scientific Publications, Oxford.

**ZL 314 ENVIRONMENTAL PHYSIOLOGY  
UNITS**

**2**

**Objectives:**

At the end of the course students should be able:

To explain how animals can cope and adapt to different kinds of environments

.

**Content:**

Regulation and adaptation to the environment at molecular level of protein synthesis, enzyme function and gene expression. Adaptive processes in nutrition, energy metabolism, thermoregulation, osmoregulation, respiration, circulation and reproduction to freshwater, seawater, estuarine and extreme terrestrial habitats: deserts, altitude, aerial and parasitic life. Effects of global warming on health status and physiological adaptations of organisms.

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Course work 40 % Final examination 60%

**Textbooks**

Willmer, P., Stone G. and Johnson, I, (2000) *Environmental Physiology of Animals*. 2<sup>nd</sup> Edition, Blackwell Science, Oxford ISBN 063203517X

Schmidt-Nelson, K. (2001) *Animal Physiology : Adaptation and environment*. 5<sup>th</sup> Edition, Cambridge Univ. Press. ISBN 0521570980

**References:**

Harding, R. (2004) *Environmental Physiology – Animal Physiology Series*. Publ. Open Univ. World Wide. ISBN 0749258535

Hochachka, P., and Somero, G. 1991 *Biochemical Adaptations*. Princeton Univ. Press

Folk, G. E., Riedesel, M. L. and Thrift, D. L. (2002) *Principles of Integrative Environmental Physiology*. Academia Press. ISBN 1572921080

Feder, M. E. and Brugger W. W. (1992) *Environmental Physiology of Amphibians*. The University of Chicago Press. ISBN 9780226239446

**ZL 315 PHYSIOLOGY OF NUTRITION  
UNITS**

**2**

*Prerequisite: ZL210, ZL 220*

**Objectives:**

At the end students should be able to:

To explain the physiological role and essence of the nutritional elements in the various processes in the body.

To conduct independent research in the field of nutrition.

**Content:**

Classification and analysis of major food classes. Physiological and chemical roles of proteins, lipids, carbohydrates, vitamins, minerals and water in the functioning of the animal body. Gastro-intestinal epithelia and juices. Absorption and intermediate metabolism of organic and inorganic nutrients. Hormonal regulation of metabolism. Nutritional disorders .

**Delivery:** 15 hours of lectures and 45 hours of practical

**Assessment:** Coursework 40%; final examination 60%.

**Textbooks:**

1. Wardlaw, G.M. and Kessel M.W.2002. Perspectives in Nutrition(5<sup>th</sup> Ed.)MaCraw Hill Companies. Inc
2. McDonald, P., R.A. Edwards and J.F.D. Greenhalgh 1981. Animal Nutrition (3rd Ed). Longman, London

**References:**

Martini, F.H. 2006. Fundamentals of Anatomy and Physiology (4th Ed). Prentice Hall Internat.. Inc.

Thibodeau G.A. and K.T. Patton 1993. Anatomy and Physiology (2nd Ed.)

Burggen W.W., French,K., Eckert R. and D.Randall 2001.Eckert Animal Physiology. Mechanism and Adaptations. W.H.Freeman

Eckert,R & G. Augustine 1988. Animal Physiology: Mechanism and Adaptations (3rd Ed). W. H. Freeman and Co., New York

Stryer, L 1996. Biochemistry (4th Ed) W.E. Freeman and Co., New York

**ZL 317 EXPERIMENTAL PHYSIOLOGY**

**2**

**UNITS**

*Prerequisite: ZL210, ZL 220*

**Objectives:**

At the end of the course students should be able:

To explain the basic techniques, principles of measurements and instruments applied to physiology and biochemistry.

To carry out research and biological assays in physiology and biochemistry.

**Content:**

**Methods of measurements: calorimetry, spectrophotometry, fluorimetry, manometry, microscopy. Enzymes as proteins and catalysts; enzyme kinetics; quantitative determination of enzyme activity. Ionic and osmotic regulation in aquatic animals. Muscle physiology: preparation and excitation of smooth and striated muscles; nerve supply and control of muscular activity. Effects of the pharmacological agents Acetylcholine, adrenaline, atropine and electrolytes on contractile tissues.**

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Course work 40%; Final examination 60%

**Textbooks:**

Alberts, B.D. J. Bray, M. Raff, K. Roberts and J.D. Watson 1983 Molecular Biology of the Cell (2<sup>nd</sup> Ed). Garland Publishers Inc  
Stryer, L. 1996 Biochemistry (4<sup>th</sup> Ed). W.E. Freeman and Co., New York

**References:**

Eckert, R & G. Augustine 1988 Animal Physiology: Mechanism and Adaptations (3<sup>rd</sup> Ed). W. H. Freeman and Co., New York.  
Engel, P.C. 1981 Enzyme Kinetics: The Steady-state Approach (2<sup>nd</sup> Ed). Chapman and Hall Ltd.  
Jones, A., R. Reed, and J. Weyers 1994 Practical Skills in Biology. Longman Group UK Limited  
Skoog, D.A. and J.J. Leary 1992 Principles of Instrumental Analysis. (4<sup>th</sup> Ed). Saunders College Publishing

**ZL 318 ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY 2**  
**UNITS<sup>3</sup>**

*Prerequisite: ZL210, ZL 220*

**Objective:**

At the end of the course students should be able:  
To explain how the endocrine system regulates the physiology, behaviour and reproductive systems of individual animals and populations.

**Content:**

Physiology of endocrine glands in the main invertebrate and vertebrate groups. Hormonal level dynamics and their effects on body functions. Sexual dimorphism and reproductive behaviour. Hormones of pregnancy and lactation in mammals; Overview of neurohormones in invertebrate growth, reproduction and metamorphosis. Biosynthesis and degradation of hormones. Contribution of endocrinology in animal production. Recent advances in endocrine physiology.

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Course work 40%; final examination 60%.

**Textbooks:**

Goldsworthy, G.J., J. Robinson, and Mordue 1979 Endocrinology. Blackie & Sons Ltd.  
Norris D.O. 1980 Vertebrate Endocrinology. Lea & Ferbiger Philadelphia

**References:**

Burggen W.W., French, K., Eckert R. and D. Randall 2001. Eckert Animal Physiology. Mechanism and Adaptations. W.H. Freeman Internat.. Inc.  
Martini, F.H. 2006. Fundamentals of Anatomy and Physiology (4th Ed). Prentice Hall

**ZL 319 PHYSIOLOGY OF SENSORY ORGANS 3**  
**UNITS\***

*Prerequisites: ZL 210, ZL 220*

**Objectives:**

At the end of the course students should be able:  
To explain the mechanisms of signal transduction of sensory organs as well as central pathways and processing of sensory information.

---

<sup>3</sup> New course

**Content:** Sense organs as receptors: ear, nose, eye, mechanoreceptors, thermoreceptors, nociceptors, interoceptors, and proprioceptors. Mechanisms of signal transduction; auditory, olfactory, visual, and somatosensory systems. Central pathways and central processing of sensory information.

**Delivery:** 30 hours of lectures and 45 hours of practicals.

**Assessment:** Course work 40%; Final examination 60%

**Textbooks:**

1. Hall, M., G. Olias, and D. Robinson 2000. *The Human Nervous System*. Springer-Verlag, Heidelberg
2. King, G. M. and D.R.N. Custance 1982. *Colour Atlas of Vertebrate Anatomy*. Blackwell Scientific Publications, Oxford.
3. Steward, O.2000. *Functional Neuroscience*. Springer-Verlag, Heidelberg

**References:**

- Clark, D. and Boutros, N. 2000. *Brain and Behaviour: An Introduction to Behavioural Anatomy*. Blackwell Science, Oxford.
- Heimer, L. 1983. *The Human Brain and the Spinal Cord: Functional Neuroanatomy and Dissection. Guide*. Springer-Verlag. Heidelberg
- Mathews, G. G. 2000. *Neurology*. Springer-Verlag, Heidelberg.
- Zeki, S. 1993 *A Vision of the Brain*. Blackwell Scientific Publications, Oxford.

**ZL 324 PRINCIPLES OF BIOSYSTEMATICS**

**3 UNITS<sup>4</sup>**

*Prerequisites: General understanding of biology, but BT 130 (Evolutionary Botany), ZL 121 (Invertebrate Zoology), ZL 122 (Chordate Zoology),and ZL 202 (Macro-Evolution)*

**Objectives:**

At the end of the course students should be able:

To explain and apply the basic techniques employed in biosystematics.

To explain the application of phylogenetic and phenetic approaches in systematics.

To explain / describe / apply the macro-molecules (e.g. DNA) in systematics.

To construct phylogenetic trees and describe evolution

To explain biological diversity and endemism

**Content:**

Definitions of taxonomy and systematics. Taxonomy and the comparative method in biology. Phenetics, keys, identification, nomenclature and classification. Numerical taxonomy. Cytotaxonomy. Proteins, enzymes and molecular taxonomy. Phylogenetic reconstructions and related methods. Cladistics: assumptions, philosophy and use of the criteria of parsimony. Biosystematics in the conservation of biological diversity.

**Delivery:** 30 hours of lectures and 45 hours of practicals.

**Assessment:** Course work 40%; Final examination 60%.

**Textbooks:**

1. Hey, V.H. 1994. *Taxonomy and Ecology*. Oxford University Press
2. Quicke, D. 1993. *Principles and Techniques of Contemporary Taxonomy*. Chapman & Hall,

---

<sup>4</sup> New course

London

**Reference:**

1. Forey, P.L., C.J. Humphries, I.L. Kitching, R.W. Scotland, D.J. Scebirt, D.M. Williams 1993. The systematics Association. Oxford University Press, Oxford

**ZL 325 TECHNIQUES IN CELL AND MOLECULAR BIOLOGY  
UNITS**

**2**

***Prerequisite: BL 111***

Objective:

At the end of the courses students should be able:

To undertake general laboratory procedures and advanced techniques in microscopy

To undertake biological separation techniques such as electrophoresis, chromatography, cell culture, dialysis, centrifugation and spectroscopy

**Content:**

General laboratory procedures: pH measurements, buffers and electrodes, lyophilization, and ultrafiltration. Cell culture methods: Objectives, growth conditions, equipment, nutrients and media; synchronous versus continuous culture of cells. Optical and electronic quantitation of cells in culture. Fundamentals of transmission electron microscopy, scanning electron microscopy, stereomicroscopy and fluorescence microscopy. Preparation of materials for microscopy. Methods of cell harvesting and fractionation. Isolation of subcellular components and macromolecules: dialysis; centrifugation: instrumentation, safety and applications; ultracentrifugation. Electrophoresis techniques: starch, polyacrylamide and agarose gel electrophoresis, isoelectric focusing, staining, detection systems and densitometry. Separation and purification of biomolecules by paper, thin-layer, gas liquid and affinity chromatography. Characterization of biomolecules by spectroscopy: UV-VIS-IR absorption spectrophotometry and fluorescence spectroscopy.

**Delivery:** 15 hours of lectures and 45 hours of practicals

**Assessment:** Coursework 40%; Final examination 60%.

**Textbooks:**

Skoog, D.A. and J.J. Leary 1992 *Principles of Instrumental Analysis*. (4<sup>th</sup> Ed). Saunders College Publishing

**References:**

Sheeler P. & D.E. Bianchi 1992 *Cell Biology, Structure, Biochemistry and Evolution* John Wiley Inc.

Plumer, D.T. 1978 *An Introduction to practical Biochemistry*. Mcgraw-Hill Book Company Limited.

Williams, B.L. and K. Wilson 1995 *Principles and Techniques of Practical Biochemistry*. Edward Arnold, London

## **ZL 336 ENTOMOLOGY**

**3 UNITS**

*Prerequisite: ZL236*

### **Objective:**

At the end of the course students should be able:

To enable the student to conduct practicals on the application of entomological science in the management of pests and disease vectors.

### **Content:**

Advance aspects of entomology including endocrinology and pathology. Applied entomology. Principles of control of insects pests and vector management of medical, agricultural and veterinary importance in tropical countries with case studies in East Africa. Pesticides in current use; insect resistance to insecticides. Biological control and the principles of integrated pest management.

**Delivery:** 30 lectures and 45 hours of practicals

**Assessment:** Course work 40%; final examination 60%.

### **Text Books:**

1. Gullan, P. J. and P.S. Cranston 1996. The Insects: An outline of Entomology. Chapman & Hall, London.
2. Hill, D.S. 1987. Agricultural Insect Pests of the Tropics and their Control. Cambridge Univ. Press

### **References:**

1. Chapman, R.F. 1998. The Insects: Structure and Function. Hodder and Stoughton. London
2. Richards, O.W. and R.G. Davies 1977. Imm's General Textbook of Entomology. Vols. 1-2. John Wiley and Sons, New York.
3. Pfadt R.E. 1985. Fundamentals of Applied Entomology (4th Ed). Macmillan Publishing Company
4. Dent, D. 1991. Insect Pest Management. CAB International

## **ZL 338 PARASITOLOGY**

**3 UNITS**

*Prerequisite: ZL236*

### **Objectives:**

To enable the student to acquire knowledge on the prevention and control of parasitic diseases of humans and animals in East Africa.

To impart knowledge on pathogenesis of parasitic infections, and the importance of immunological and molecular techniques in the study of parasites and their application to diagnostic, chemotherapy, disease prevention and control.

### **Contents:**

Pathogenesis and manifestations of parasitic infections. Bionomics of vector biology in relation to transmission of parasitic infections. Epidemiology of parasitic diseases of humans and animals in East Africa and their control. The influence of anthropogenic activities on the burden and spread of parasitic diseases. Biochemistry and physiology of parasites. Immunological and molecular techniques in relation to diagnostics, chemotherapy, prevention and control.

**Delivery:** 30 lectures and 45 hours of practical practicals

**Assessment:** Course work 40%; final examination 60%.

**Textbooks:**

1. Roberts, L.S. and J. Janovy, Jr. 2000. Gerald D. Schmidt and Larry S. Roberts' Foundations of Parasitology (6th Ed). McGraw Hill. New York.
2. Marquardt, W.C. R.S. Demaree and R.S. Grieve 1999. Parasitology and Vector Biology. (2nd Ed). Academic Press.

**References:**

1. Smyth J.D. 1994. Introduction to Animal Parasitology (3rd Ed). Cambridge University Press, Cambridge.
2. Warren-Kenneth, S. (Ed) 1997. Immunology and Molecular Biology of Parasitic Infections. (3rd Ed). Blackwell Science, Oxford

**ZL 330 TRENDS IN ZOOLOGY**

**2 UNIT**

**Objective:**

At the end of the course students should be able:

To explain the contemporary issues at the frontier of research in Zoology and other significant contributions in science.

**Content:**

The course deals with contemporary issues at the frontiers of research in Zoology. Their conclusion may still be wanting; nevertheless they are to be selected to reflect existing academic and societal needs. A modest list currently includes the research interests of staff members in the Department, famine alleviation by domestication of novel plants and animals, revolutionary ideas towards vermin and pest control, somatic hybridisation and hybrid formation between major taxa, chemotherapy and immunisation against HIV and primate arboviruses. Blotting techniques and strategies for gene amplification, genome mapping in select animal taxa; impact of zero gravity on biological systems.

**Delivery:** 30 hours of lectures.

**Assesment:** Course work 40 %; Final paper 60%.

**ZL 331 IMMUNOLOGY OF PARASITISM  
UNITS<sup>5</sup>**

**2**

*Prerequisites: BL 207, ZL 228, & ZL 328*

**Objectives:**

At the end of the course students should be able:

To explain and describe the host responses to parasitism and of parasites to hosts focusing on the mammalian immune response to parasites of medical and veterinary importance.

---

<sup>5</sup> New course

Explain immunity to important parasitic diseases – helminthiases, malaria, trypanosomes etc.  
Apply immunological techniques in the diagnosis / confirmation of parasitic diseases, and appreciate their advantages and limitations  
Explain / describe the principles of vaccination against parasites

**Content:** Introduction – general principles of immunity and immune mechanisms. Excretory, secretory and somatic antigens of parasites; allergens. Immune evasions mechanisms and immunopathology of parasitism. Immunodiagnosis of parasites, including immunodiagnostic techniques used and their advantages and disadvantages compared to parasitological diagnosis. Principles of vaccination against parasites – discussion on live attenuated vaccines and subunit vaccines; adjuvant and delivery systems. Description of immunity to particular representative parasites: immunity to worms of the gut; immunity to schistosomes; immunity to enteric protozoa; immunity in malaria; immunity to trypanosomes; immunity in *Theileria* species. Radio-immunometric assays, ELISA etc.

**Delivery:** 15 hours of lectures, and 45 hours of practicals

**Assessment:** Course work 40 %; Final examination 60%.

**Textbook:**

1. Eleanor M. Riley & Richard K. Grencis (eds) 2003. *Parasite Immunology*
2. Warren-Kenneth, S. (Ed) 1997. *Immunology and Molecular Biology of Parasitic Infections* (3rd Ed). Blackwell Science, Oxford

**References:**

1. I.M. Roitt, J. Brostoff & D.K. Male 1996. *Immunology* 4th ed. by Mosby, St. Louis.

**ZL 332: MOLECULAR BIOLOGY OF PARASITES**

**3 UNITS\***

*Prerequisites:* ZL 228, ZL 328

**Objective:**

At the end of the course students should be able:

To utilise the widely used techniques in molecular parasitology.

To explain the application the application of molecular techniques to chemotherapy, epidemiology of parasitic disease, prevention and control.

**Contents:**

*Introduction* – Scope, brief history and current state of molecular parasitology. *Review* of the structure and form of DNA and RNA. *Basic tools in molecular parasitology* (isolation of parasite DNA and RNA, visualisation and analysis of DNA and RNA, hybridization, DNA probes, pulsed field gel electrophoresis, DNA sequencing and other methods). *PCR* (polymerase chain reaction) – applications in molecular taxonomy and diagnosis and other areas of parasitology. *Ribosomal (RNA) genes* and their uses in molecular parasitology. *Molecular taxonomy* - applications of DNA methods in taxonomy: testing the validity of morphological features used to identify parasite species, identification of cryptic (complex) species and of host induced morphological variation in parasites. *Molecular diagnosis of parasites*. *Epiemiology* of parasitic diseases – applications of DNA-based methods to epidemiological studies. *Determination of life cycles* based on nucleotide sequences. *Population genetics* of parasites; *Molecular phylogeny* (evolutionary history) of parasites. *Antigenic variation* in parasites – its molecular basis. *Recombinant vaccines* against parasites - Advantages of recombinant antigen vaccines over native antigen vaccines, problems and potential solutions (focus on vaccines for malaria,

trypanosomes, *Theileria*, cattle ticks). Population genomics and bioinformatics – decoding genomes of vectors e.g. *Anopheles gambiae*, human, *Aedes aegypti* etc.

**Delivery:** 30 hours of lectures; 45 hours of practicals

**Assessment:** Course work 40 %; Final examination 60%.

**Text books:**

1. John C. Boothroyd and Richard Komuniecki 1995. Molecular Approaches to Parasitology
2. John E. Hyde and Van Nostrand Reinhold, 1990. Molecular Parasitology
3. J. Joseph Marr and Miklos Muller (Eds) 1995. Biochemistry and Molecular Biology of Parasites. Academic Press.

**ZL 333: INSECT ECOLOGY**

**3 UNITS<sup>6</sup>**

*Prerequisites: ZL 226, ZL 229, ZL 326*

**Objectives:**

At the end of the course students should be able:

To explain the important aspects of Insect ecology.

To design some practical experiments in the field.

**Content:**

Basic ecological principles drawing examples from Insects. Insect trophic relations (plant-herbivorous insect interactions; interactions of predatory insects with their prey, including prey-predator dynamics; parasitic insects and their hosts; mutualistic associations of insects; pollination ecology; insect decomposers, including forest and leaf litter insects, fungal-growing insects, dung associated insects and carrion feeders). Analysis of Insect populations. The diversity of insects. Insects in agro-ecosystems (sampling, monitoring and forecasting; yield loss assessment). Adaptive radiation in insects, utilization of different resources and ecological niches in order to minimize intra- and inter-specific competition in order to ensure maximum survival. Mimicry, social relations of insects as a strategy for survival etc. The use of insects in biodiversity monitoring. Ecological methods for sampling and identification of insects.

**Delivery:** 30 hours of lectures; 45 hours of practicals.

**Assessment:** Course work 40 %; Final examination 60%.

**Text books:**

1. Price, P.W. 1984. Insect Ecology, Second Edition. John Wiley & Sons, New York, 607 pp.
2. Resh, V.H. and Rosenberg, D.M. (eds) 1984. The Ecology of Aquatic Insects. Praeger, NY.

**References:**

1. Dent, D. 1991. Insect Pest Management. CAB International, Oxon, 604 pp.
2. Price, P.W. 1975. Insect Ecology. Wiley Interscience, New York etc.
3. Szujewski, A. 1987. Ecology of Forest Insects. Dr. W. Junk Publishers, Dordrecht etc., pp.
4. Schowalter 2000 Insect Ecology: An ecosystem Approach. Academic Press.
5. Ward J. V. 1992. Aquatic Insect Ecology. John Wiley & Sons

**ZL 334: INSECT SYSTEMATICS**

**3 UNITS<sup>7</sup>**

---

<sup>6</sup> New course

<sup>7</sup> New course

*Prerequisites: ZL 226, ZL 229, ZL 326*

**Objectives:**

At the end of the course students should be able:

To explain the advanced aspects of insect taxonomy not covered in the introductory courses.

To follow taxonomic keys and the principles of Zoological Nomenclature to describe, identify and name any insect specimen may come across.

To explain the most recent techniques in Insect Taxonomy e.g. cytotaxonomy and DNA techniques.

**Content:**

Introducing various concepts in taxonomy, different approaches to taxonomy (traditional taxonomy and the biological species concept, numerical taxonomy (phenetics) and phylogenetic taxonomy (cladistics); the International Code of Zoological Nomenclature; Class Insecta and its position in Super-Phylum Arthropoda; a detailed survey of the Orders of insects; Practical Insect Taxonomy (preparation of whole insects or parts e.g. genitalia, for identification); Reference collections in insect taxonomy; Including preservation of insects, pinning, mounting, insect boxes, killing jars etc. Cytotaxonomy (Examples from *Drosophila* or *Anopheles* mosquitoes, DNA probes, PCR, electrophoresis etc. Construction of taxonomic keys e.g. the Dichotomous key. Population genomics, bioinformatics and their role in the identification of vectors and the respective pathogens they transmit. The phylogeny of insects by use of cladistic methods; parsimony principle.

**Delivery:** 30 hours of lectures; 45 hours of practicals.

**Assessment:** Course work 40 %; Final Examination 60%.

**Text books:**

Quicke, D.L.J. 1993. Principles and Techniques of Contemporary Taxonomy. Blackie Academic and Professional, London.

McGavin, G.C. 1997. Insects and Other Terrestrial Arthropods: Expedition Field Techniques. RGS, London.

**References**

Borror, D., Triplehorn, C. and Johnson, N. 1998. An Introduction to the study of Insects 7<sup>th</sup> Edition.

2. Wiley, E.O., Siegel-Causey, D., Brooks, D.R. and Funk, V.A. 1991. The Compleat Cladist: A Primer of Phylogenetic Procedures.

3. McGavin, G.C. 1992. The Pocket Guide to Insects of the Northern Hemisphere

4. Scholz, C.H. and Holm, E. 1985. Insects of Southern Africa. University of Pretoria, Pretoria.

**ZL 339: ECOTOXICOLOGY**

**3 UNITS<sup>8</sup>**

*Prerequisites: ZL 314, ZL 317, ZL 318*

**Objectives:**

At the end of the course students should be able:

To explain the physiological alterations which occur as a result of exposure to environmental pollutants (contaminants) both at the cellular and organism levels.

---

<sup>8</sup> New course

To classify the major classes of pollutants and describe their effects the cellular level, and explain the molecular mechanisms of toxicity, and the interactive (synergistic, additive etc.) effects of pollutants.

**Content:**

Major classes and sources of pollutants. Biochemical and physiological effects of pollutants at cellular, organ and organism level – absorption, metabolism, osmoregulation, cardiovascular, respiratory, endocrine, reproductive and neurological response. Molecular mechanisms of toxicity. Interactive effects of pollutants in organisms. Pollutants and stress.

**Delivery:** 30 hours of lectures; 45 hours of practicals

**Assessment:** Coursework 40%; final exams 60%

**Textbooks:**

Walker CH, Hopkin, S. P., Sibly, R. M. and Peakall D. B. 2003 Principles of Ecotoxicology, Taylor & Francis Publ.

Jorgensen S. E. 2000 Principles of pollution abatement. Elsevier Science Publ.

Vernberg F. J. and Vernberg B. W. 1974. Pollution and physiology of marine organisms. Academic Press.

**ZL 337: MOLECULAR PHYSIOLOGY**

**3 UNITS\***

*Prerequisites: ZL 314, ZL 317, ZL 318*

**Objectives:**

At the end of the course students should be able:

To explain the advanced molecular concepts of physiological processes.

**Content:**

Enzyme kinetics, velocity, affinity, molecular forms and allosteric modulation. Passive transport: diffusion, electrical gradients and ion channels. Active transport: basic properties, primary and secondary cellular-molecular mechanisms, Sodium–potassium pump. Calcium membrane transport. Extracellular signals, receptor proteins and signal transduction. Cyclic nucleotide signaling system. Second messenger system. Calcium signaling systems, modulation and calcium binding proteins.

**Delivery:** 30 hours of lectures; 45 hours of practicals

**Assessment:** Coursework 40%; final exams 60%

**Textbooks:**

Hille B. 2001. Ion channels of excitable membranes. Publ. Sinauer, Sunderland.

Kinne R. K. H. 1990. Basic principles in transport. Publ. Karger Basel

Palmer T. 1995. Understanding enzymes. Prentice Hall / Ellis Horwood.

5. Michal G. 1999. Biochemical pathways: An atlas of biochemistry and molecular biology. Publ. Wiley NY

**ZL 340: ECONOMIC ZOOLOGY**

**3 UNITS<sup>9</sup>**

Objectives:

At the end of the course students should be able:

**To explain and make analysis of requirements for keeping and breeding of various animals for commercial purposes.**

---

<sup>9</sup> New course

**To explain various legislations pertaining to keeping and exporting of wild animals and their products.**

To explain various market forces that determine productivity of wildlife produces.

**Content:**

A survey of animals with commercial value. Aspects of keeping and breeding invertebrates and vertebrates. Sponges, nematodes, parasitoids for biological control of pests. Annelids mass production, choice of soil structure and their role in soil fertility. Insects and arachnids culture for food, chemicals and other commercial products. Insects as pollinators. Bee-keeping, nutrition, rearing queens, harvesting and characterization of honey. Culture and breeding for commercial production of mollusc, amphibians, reptiles, fish, birds and mammals. Legislation on keeping and exporting wildlife and their products. Indigenous knowledge on utilization of wild animals. Sustainable exploitation of animal biodiversity. Entrepreneurship and management for wildlife utilization.

**Delivery:** 30 Hours of Lectures, and 45 hours of practicals

**Assessment:** Course work 40%; Final examination 60%.

**Text books:**

Jean-Prost, P. 1994. Apiculture: Know the Bee, Manage the Apiary. Intercept, London.

Shekar P. and M. Hardingham 1995. Sericulture and Silk Production: A Handbook. Practical Action Publishing.

**References:**

Conrad, R. 2007. Natural Beekeeping: Organic Approaches to Modern Apiculture. Chelsea Green, London.

Deeming, D.C. (Editor) 1999. The Ostrich: Biology, Production and Health. CABI Publishing

Webb, G. J. W., C. Manolis and P. J. Whitehead (eds.) 1987 Wildlife Management: Crocodiles and Alligators Surrey.

Stievenart C. and Hardouin J. (1990). *Manual for breeding giant African snails in the tropics.*

F.A.O. Centre for Technical and Agricultural Cooperation. Wageningen, Holland.

Murphy B. (2000). *Breeding and growing snails commercially in Australia.* RIRDC Publications.