DEPARTMENT OF ZOOLOGY AND ENVIRONMENTAL BIOLOGY
FACULTY OF BIOLOGICAL SCIENCES

POSTGRADUATE PROGRAMMES

Masters of Science (M.Sc.) and Doctor of Philosophy (Ph.D)

DEPARTMENT OF ZOOLOGY AND ENVIRONMENTAL BIOLOGY
POSTGRADUATE PROGRAMMES

Members of the Postgraduate Departmental Board of Zoology and Environmental Biology

B.O. Mgbenka, B.Sc. (Nigeria), M.Sc., Ph.D. (Auburn)	Professor (Head)
J. E. Eyo, B.Sc. (Sokoto), M.Sc., Ph.D. (Nigeria)	Professor (Dean, FBS)
F. C. Okafor, B.Sc., Ph.D. (Nigeria), Dip. (Denmark)	Professor
P.O. Ubachukwu, B.Sc., M.Sc., PGDE, Ph.D. (Nigeria)	Professor
V.C. Ejere, B.Sc., M.Sc., Ph.D. (Ife)	Senior Lecturer
N. Ivoke, B.Sc., M.Sc., Ph.D. (Nigeria)	Senior lecturer
I.C. Okoye, B.Sc. (Makurdi), M.Sc. (Maiduguri), Ph.D. (Jos)	Senior Lecturer
C.D. Nwani, B.Sc. (Port Harcourt), M.Sc., Ph.D. (Nigeria)	Senior Lecturer
G.E. Odo, B.Sc., M.Sc., Ph.D. (Nigeria)	Senior Lecturer
R.N.N. Obiezue, B.Sc., M.Sc., Ph.D. (Nigeria)	Senior Lecturer
G.C Onyishi, B.Sc., M.Sc., Ph.D. (Nigeria)	Senior Lecturer
C.I. Atama, B.Sc., M.Sc. Ph.D. (Nigeria)	Senior Lecturer
F.N. Eke, B.Sc., M.Sc., Ph.D. (Nigeria)	Senior Lecturer
N. E. Ezenwaji, B.Sc. (Nig.), M.Sc. (Awka), Ph.D. (Nigeria)	Senior Lecturer
I. E. Onah B.Sc., M.Sc., Ph.D. (Nigeria)	Lecturer I

List of Approved Supervisors

1. **Prof. FC Okafor** B.Sc., Ph.D. (Nig.)	Parasitology, Entomology, Physiology, Genetics, Environmental Biology, Ecology (Ph.D. and M.Sc.)
2. **Prof. JE Eyo** B.Sc. (Sokoto), M.Sc., Ph.D. (Nig.)	Fisheries, Hydrobiology, Physiology, Parasitology, Genetics, Entomology Animal Biotechnology, Environmental Biology, Ecology (Ph.D. and M.Sc.)
3. **Prof. BO Mgbenka** B.Sc. (Nig.), M.Sc., Ph.D. (Auburn)	Fisheries, Hydrobiology, Physiology, Environmental Biology, Genetics, Ecology (Ph.D. and M.Sc.)
4. **Prof. (Mrs.) PO Ubachukwu** B.Sc., M.Sc., Ph.D. (Nig.)	Parasitology, Entomology, Physiology, Genetics (Ph.D. and M.Sc.)
5. **Dr. VC Ejere** B.Sc., M.Sc., Ph.D. (Ife.)	Physiology, Genetics, Molecular Biology, Animal Biotechnology, (Ph.D. and M.Sc.)
6. **Dr. N Ivoke** B.Sc., M.Sc., Ph.D. (Nig.)	Parasitology, Entomology, Physiology, Molecular Biology, Animal Biotechnology (Ph.D. and M.Sc.)
7. **Dr. IC Okoye** B.Sc. (Makurdi), M.Sc. (Maiduguri), Ph.D. (Jos.)	Parasitology, Entomology, Physiology, Molecular Biology (Ph.D. and M.Sc.)
8. **Dr. GE Odo** B.Sc., M.Sc., Ph.D. (Nig.)	Fisheries, Hydrobiology, Entomology, Physiology, Environmental Biology, Ecology (Ph.D. and M.Sc.)

9. **Dr. (Mrs.) RNN Obiezue** B.Sc., M.Sc., Ph.D. (Nig.)	Parasitology, Entomology, Genetics, Environmental Biology, Ecology (Ph.D. and M.Sc.)
10. **Dr. CD Nwani** B.Sc., M.Sc., Ph.D. (Nig.)	Fisheries, Hydrobiology, Genetics, Animal Biotechnology, Physiology (Ph.D. and M.Sc.)
11. **Dr. (Mrs.) GC Onyishi** B.Sc., M.Sc., Ph.D. (Nig.)	Parasitology, Entomology, Physiology, Environmental Biology, Ecology (M.Sc.)
12. **Dr. (Mrs.) FN Ekeh** B.Sc., M.Sc., Ph.D. (Nig.)	Entomology, Parasitology, Physiology, Environmental Biology, Ecology (M.Sc.)

Brief History

"To restore the dignity of man" is the guiding principle on which the Department of Zoology and Environmental Biology (formerly, Department of Zoology) was founded. This was way back in 1961. The Department was envisioned to be the first indigenous citadel of learning where zoology courses were taught to young Nigerians, Africans and global youths. The Department came out with the clear objective of giving effective training to Nigerians, Africans and global young men and women thus filling the need for the national and international production of high quality, competent and competitive zoologist which possesses the attitude and attributes essential for the building of the nation to a desire focused direction and excellent level of intellectual development. These objectives were articulated with great clarity aimed at producing graduates who are versatile and of excellent intellectual fibre in addition to acquiring through passage within the university, a sound and impeccable moral character and a burning desire and willingness to devote themselves and their energies towards making great the Nigerian nation where excellence, truth and justice prevails. Against this background, the founding fathers in 1961 established the foundation Faculties of Science, Arts and The Use of Library and Study Skill in addition to Engineering, and for the first time in Nigeria, the School of General Studies. Within the Faculty of Science, the Departments of Zoology, Botany, Physics and Chemistry were inaugurated as service and foundation departments essential for manpower development.

The Department of Zoology and Environmental Biology offers postgraduate courses leading to the M.Sc., M.Sc./Ph.D. and Ph.D. Degree in Zoology and Environmental Biology, with specialization (options) in Animal and Environmental Physiology, Parasitology and Public Health, Entomology and Forensic Sciences, Fishery Sciences, Hydrobiology/Aquatic Sciences, Ecology and Environmental Biology, and Animal Genetics, Molecular Biology and Biotechnology.

Philosophy, Objectives and Scope of the Programme

Philosophy: In accordance with the philosophy of the University, the Zoology and Environmental Biology programme is planned to promote general and practical education in Zoology and Environmental Biology. Animals' existence is totally dependent on the abiotic and biotic variables of its environment. The knowledge of zoology and environmental biology is the central theme in such emerging areas like ecotoxicology, animal biotechnology, biodiversity studies, ecosystem monitoring, environmental management and animal bioinformatics. Environmental biology encompassing such multidisciplinary area has become an important issue in animal biodiversity prospecting and environmental management. Hence, it is imperative that the graduate student should be properly trained to enable him/her play the expected pivotal roles in these emerging field of learning. Thus to play this role, adequate knowledge of animal and environmental physiology, parasitology and public health, entomology and forensic sciences, fishery sciences,

hydrobiology/aquatic sciences, ecology and environmental biology, and animal genetics, molecular biology and biotechnology is imperative and has been built into the curriculum.

Objectives: The objectives of the programmes are to;

1. Train graduate students to respond to the global challenges and the needs of the Nigerian society in particular, through focused training in specialized areas of animal and environmental physiology, parasitology and public health, entomology and forensic sciences, fishery sciences, hydrobiology/aquatic sciences, ecology and environmental biology, animal genetics, animal molecular biology, animal bioinformatics and animal biotechnology, with additional emphasis on entrepreneurship, research design, study skills and research data analysis.
2. Equip students with adequate practical knowledge that will enable them be self reliant and captains of biomedical, agro-aquacultural, petrochemical, environmental and human development industries.
3. Equip students with adequate research techniques that will enable them function as research officers in biomedical, agro-aquacultural, petrochemical and environmental sectors of both national and global economies.
4. Give adequate, effective and resourceful training needed for the national and international production of high quality, competent and competitive zoologist, parasitologist, physiologist, geneticist and environmentalist that possess the attitude, character and attributes essential for building the Nigeria nation to excellent level of societal development.

Scope: Student are train in the general areas of management and entrepreneurship, information communication technology (ICT) and research methodology, and ecology and environmental management along with courses in their specialized areas such as parasitology, fisheries sciences, physiology, entomology, environmental biology genetics and animal biotechnology, and take advanced courses in these areas that offer them greater exposure and in-depth knowledge in their chosen options. In addition, graduate students specializing in Animal and Environmental Physiology are required to take elective courses in physiology of stress and stress management, advanced gastrointestinal physiology and diseases, advanced respiratory physiology and diseases, advanced reproductive physiology and diseases and environmental impact assessment. Graduate students specializing in Parasitology and Public Health are required to take elective courses in climate change and public health, parasite genetic resources and climate change, adaptation and mitigation issues in climatic change and parasitic diseases, vector biology, control and climate change, environmental impact assessment and climate change and ecosystem. Graduate students specializing in Entomology and Forensic Sciences are required to take elective courses in insect biodiversity, evolution and climate change, aquatic insects, economic entomology and human welfare, vector biology, control and climate change, environmental impact assessment and climate change and ecosystem. Graduate students specializing in Fisheries Science are required to take elective courses in impact of climate change on fish production and fishing communities. Graduate students specializing in other disciplines equally undertake relevant elective courses.

Entry Requirements for the Programmes

1. Graduate of the University of Nigeria or of any other recognized University who obtained the approved degree of Bachelor of Sciences in Zoology or any other related discipline with at least a GPA of 2.5 on a 5 point scale or 2.0 on a 4 point scale or it equivalent (50% and above) are admitted into the Masters degree programme.
2. A candidate with first class honors Bachelor's Degree in Zoology or any other related discipline from a recognized university may be admitted into the Masters/Ph.D. programme.
3. A candidate with Master's Degree in Zoology or any related discipline from University of Nigeria or any other recognized university, whose GPA is below 3.50 on a 5 point scale or

below 3.0 on a 4 point scale shall not qualify for admission into the Masters/Ph.D. programme. Such a candidate may be admitted into the Masters programme.

4. A candidate with Master's Degree in Zoology or any related discipline from University of Nigeria or any other recognized university with a minimum GPA of 3.50 on a 5 point scale or 3.0 on a 4 point scale wishes to do a Ph.D. in another related discipline other than the one which he obtained the Masters degree, may be admitted into the Masters/Ph.D. in the new area.
5. Graduates of Zoology or any other related discipline from University of Nigeria or any other recognized university with a minimum GPA of 3.50 on a 5 point scale or 3.0 on a 4 point scale may be admitted into the Ph.D. programme.

Mode of Study for Master's Degree Programme

Study for the degree of Master shall be prosecuted by course work and project report. The coursework shall be examined in written papers moderated by the Board of Internal and External Examiners. The project report shall be defended in an oral examination before an external examiner, who shall score a total of 60%, while the other 40% shall be shared between the supervisor(s) (20%) and internal examiner(s) (20%). All masters degree students must register and pass one Faculty course of 3 units on Research methodology and application of ICT in research which shall include a workshop to be organized by the School each session. The grades are awarded by the faculty, while the School awards a certificate of participation without which the result is incomplete.

All coursework should be taught and examined within the first two semesters of the programme. The third semester is devoted to project, seminars/ workshop and project report defense.

Mode of Study for Doctoral Degree Programme

All doctoral degree programmes shall have coursework with written examinations and a research thesis that involves oral defense and requires the participation of an external examiner. All doctoral students shall register and pass a 3 unit Faculty thesis course on Synopsis and research grant writing which shall include a workshop to be organized by the School each session. The grades are awarded by the faculty, while the School awards a certificate of participation without which the result is incomplete.

Candidates who wish to prosecute their doctoral in the same Department but in another area of specialization must do a M.Sc. coursework in the new area.

All doctoral coursework should be taught and examined within the first two semesters of the programme. Based on the recommendation of the Departmental Postgraduate Committee to the School; (i) students that scored 50% and above in all courses shall be asked to proceed, (ii) those that scored an average of 50% and above but failed a course or more shall be asked to proceed but will be required to pass the failed courses in the next session, (iii) those that failed to make a minimum of 50% average shall be asked to repeat the year or withdraw.

Duration of Programmes

Duration of Masters programme

Full time: A minimum of 3 semesters
A maximum of 5 semesters

Part time: A minimum of 4 semesters
A maximum of 6 semesters

Duration of Masters /Ph.D. programme

Full time: A minimum of 8 semesters
A maximum of 12 semesters
Part time: A minimum of 10 semesters
A maximum of 15 semesters

Duration of Ph.D. programme
Full time: A minimum of 6 semesters
A maximum of 9 semesters
Part time: A minimum of 8 semesters
A maximum of 12 semesters

Employment Opportunities
Graduates of Zoology and Environmental Biology can find employment in different specialized sectors of the national and global economy. Relatively few of these sectors include; medical and biomedical sector such as hospitals, clinics, public health facilities, pharmaceutical companies, diseases vectors control departments, World Health Organization, medical and biomedical research institutions, etc., for professional in parasitology and public health, entomology and forensic sciences, animal biotechnology and physiology.

In agricultural establishments, pest control and crop protection units, aquaculture facilities, Institute of Marine and Oceanographic Research, Institute of Freshwater Fish Research, Institute of Tropical Agriculture, fisheries unit of Ministry of Agriculture, veterinary clinics, snailry, laboratory/small animal production facilities, Food and Agricultural Organization, Food and Drugs Administration Agencies, etc., for professional entomologist, fisheries scientist, aquaculturist, animal biotechnologist and hydrobiologist.

Urban and municipal waste management, sewage management, sanitation projects, pollution and environmental protection agencies, environmental impact assessment facilities, wildlife and games resorts, bio-parks, biodiversity prospecting projects, museums of natural history and petrochemical industries (oil and gas industries), etc., for ecologist, hydrobiologist, mammalogist, environmental biologist, conservationist, animal biotechnologist, etc.

They can also find work in industries such as breweries, feed production, food processing and educational facilities as auxiliary teachers, and in agricultural and commercial banks as bankers.

Areas of specialization
- Animal and Environmental Physiology
- Parasitology and Public Health
- Entomology and Forensic Sciences
- Fishery Science and Aquaculture
- Hydrobiology/Aquatic Sciences
- Ecology and Environmental Biology
- Animal Genetics, Molecular Biology and Biotechnology

Stress Areas

Basic Courses in Zoology and Environmental Biology	-	0
Animal and Environmental Physiology	-	1
Parasitology and Public Health	-	2
Entomology and Forensic Sciences	-	3
Fishery Science and Aquaculture	-	4
Environmental Biology/Animal Ecology	-	5

Hydrobiology/Aquatic Sciences	-	6
Animal Genetics, Molecular Biology and Biotechnology	-	7
Seminar	-	8
Project	-	9

Degrees Awarded

Masters degrees
M.Sc. (Animal and Environmental Physiology)
M. Sc. (Parasitology and Public Health)
M.Sc. (Entomology and Forensic Sciences)
M. Sc. (Fishery Science and Aquaculture)
M.Sc. (Animal Ecology and Environmental Biology)
M. Sc. (Hydrobiology/Aquatic Sciences)
M.Sc. (Animal Genetics, Molecular Biology and Biotechnology)

Doctor of Philosophy
Ph.D. (Animal and Environmental Physiology)
Ph.D. (Parasitology and Public Health)
Ph.D. (Entomology and Forensic Sciences)
Ph.D. (Fishery Science and Aquaculture)
Ph.D. (Animal Ecology and Environmental Biology)
Ph.D. (Hydrobiology/Aquatic Sciences)
Ph.D. (Animal Genetics, Molecular Biology and Biotechnology)

Course Outline (M.Sc. Programmes)

M.Sc. (Animal and Environmental Physiology)

Course No	**Title**	**Units**
First Semester		
ZEB 611	Research techniques in physiology	3
ZEB 613	Advanced comparative physiology	3
ZEB 615	Cell physiology	3
ZEB 651	Ecological methods	3
Elective		3
Sub total		**15 units**
Elective		
ZEB 617	Physiology of stress and stress management	3
ZEB 619	Advanced gastrointestinal physiology and diseases	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 612	Environmental physiology	3
ZEB 614	Organismal physiology	3
ZEB 652	Advanced animal ecology	3
Elective		3
Sub total		**15 units**
Elective		
ZEB 616	Advanced respiratory physiology and diseases	3
ZEB 618	Advanced reproductive physiology and diseases	3
ZEB 646	Environmental impact assessment	3
Third Semester		

Course No	Title	Units
PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 681	Physiology seminar	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**45 units**

M.Sc. (Parasitology and Public Health)

Course No	Title	Units
First Semester		
ZEB 621	Research techniques in parasitology and public health	3
ZEB 623	Principles, concepts and problems in parasitology and public health	3
ZEB 625	Diseases of protozoan parasites and arthropods	3
ZEB 651	Ecological methods	3
Electives		3
Sub total		**15 Units**
Elective		
ZEB 627	Parasite genetic resources and climate change	3
ZEB 629	Climate change and public health	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 622	Advanced helminthology (with emphasis on transmission and diseases of helminth parasites)	3
ZEB 624	Comparative physiology and biochemistry of parasites	3
ZEB 626	Epidemiology, public health and control of parasitic diseases in the tropics	3
ZEB 628	Immunology of parasitic diseases	3
ZEB 652	Advanced animal ecology	3
Elective		3
Sub total		**21 Units**
Electives		
ZEB 620	Vector biology, control and climate change	3
ZEB 646	Environmental impact assessment	3
ZEB 656	Climate change and ecosystem	3
Third Semester		
PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 683	Parasitology and public health seminar	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**51 units**

M.Sc. (Entomology and Forensic Sciences)

Course No	Title	Units
First Semester		
ZEB 631	Research techniques in entomology and forensic science	3
ZEB 633	Arthropod taxonomy (emphasis on insects and arachnids)	3
ZEB 635	Medical, veterinary and forensic entomology	3
ZEB 637	Insect ecology and forensic sciences	3
ZEB 639	Stored products entomology	3

ZEB 651	Ecological methods	3
Elective		3
Sub total		**21 Units**
Elective		
ZEB 630	Insect biodiversity, evolution and climate change	3
ZEB 663	Aquatic insects	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 632	Pesticide ecobiology	3
ZEB 634	Advanced insect physiology and biochemistry	3
ZEB 636	Management of harmful insects	3
ZEB 652	Advanced animal ecology	3
Elective		3
Sub total		**18 units**
Elective		
ZEB 638	Economic entomology and human welfare	3
ZEB 620	Vector biology, control and climate change	3
ZEB 646	Environmental impact assessment	3
ZEB 656	Climate change and ecosystem	3
Third Semester		
PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 685	Entomology/forensic science seminar	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**54 units**

M.Sc. (Fishery Science and Aquaculture)

Course No	**Title**	**Units**
First Semester		
ZEB 641	Research techniques in Fishery Science and aquaculture	3
ZEB 643	Advanced biology of fishes	3
ZEB 645	Tropical aquaculture	3
ZEB 651	Ecological methods	3
Elective		3
Sub total		**15 Units**
Elective		
ZEB 647	Fish production and climate change	3
ZEB 640	Climate change and fishing communities	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 642	Fisheries and aquaculture management	3
ZEB 644	Fisheries and fishing technology	3
ZEB 646	Environmental impact assessment	3
ZEB 652	Advanced animal ecology	3
Elective		3
Sub total		**18 Units**
Elective		
ZEB 648	Fish genetic resources and climatic change	3
ZEB 668	Adaptation and mitigation issues in climatic change and aquatic resources	3
ZEB 656	Climate change and ecosystem	3

Third Semester		
PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 687	Fisheries and aquaculture seminar	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**48 units**

M.Sc. (Animal Ecology and Environmental Biology)

Course No	**Title**	**Units**
First Semester		
ZEB 651	Ecological methods	3
ZEB 653	Ecotoxicology and environmental safety	3
ZEB 655	Wild life conservation, games and parks management	3
ZEB 657	Behavioral ecology	3
ZEB 659	Ecosystem management	3
Elective		3
Sub total		**18 Units**
Elective		
ZEB 663	Aquatic insects	3
ZEB 630	Insect biodiversity, evolution and climate change	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 652	Advanced animal ecology	3
ZEB 654	Ecology of tropical ecosystems	3
ZEB 646	Environmental impact assessment	3
ZEB 656	Climate change and ecosystem	3
ZEB 658	Ecology and management of tropical wetlands	3
Elective		3
Sub total		**21 Units**
ZEB 666	Aquatic resources and climatic change	3
ZEB 668	Adaptation and mitigation issues in climatic change and aquatic resources	3
Third Semester		
PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 689	Seminar in animal ecology/environmental biology	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**54 units**

M.Sc. (Hydrobiology/Aquatic Sciences)

Course No	**Title**	**Units**
First Semester		
ZEB 651	Ecological methods	3
ZEB 661	Research techniques in aquatic ecosystem	3
ZEB 643	Advanced biology of fishes	3
ZEB 663	Aquatic insects	3
ZEB 665	Management of freshwater resources	3
Elective		3
Sub total		**18 Units**
Elective		

ZEB 667	Climate change and communities exploiting aquatic resources	3
ZEB 647	Fish production and climate change	3
ZEB 640	Climate change and fishing communities	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 652	Advanced animal ecology	3
ZEB 662	Aquatic resources	3
ZEB 664	Advanced limnology	3
ZEB 646	Environmental impact assessment	3
Elective		3
Sub total		**18**
ZEB 666	Aquatic resources and climatic change	3
ZEB 668	Adaptation and mitigation issues in climatic change and aquatic resources	3
ZEB 656	Climate change and ecosystem	3
Third Semester		
PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 680	Seminar in hydrobiology/aquatic sciences	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**51 units**

M.Sc. (Animal Genetics, Molecular Biology and Biotechnology)

Course No	**Title**	**Units**
First Semester		
ZEB 651	Ecological methods	3
ZEB 671	Advanced animal molecular biology I	3
ZEB 673	Advanced animal biotechnology I	3
ZEB 675	Advanced animal genetics I	3
ZEB 677	Research techniques in animal genetics / molecular biology/ biotechnology	3
Elective		3
Sub total		**18 Units**
Elective		
ZEB 679	Animal breeding and genetics	3
ZEB 615	Cell physiology	3
ZEB 617	Physiology of stress and stress management	3
ZEB 619	Advanced gastrointestinal physiology and diseases	3
Second Semester		
ZEB 602	Bioinformatics	3
ZEB 652	Advanced animal ecology	3
ZEB 672	Advanced animal molecular biology II	3
ZEB 674	Advanced animal biotechnology II	3
ZEB 676	Advanced animal genetics II	3
Elective		3
Sub total		**18 units**
Elective		
ZEB 627	Parasite genetic resources and climate change	3
ZEB 648	Fish genetic resources and climatic change	3
ZEB 612	Environmental physiology	3
ZEB 614	Organismal physiology	3
Third Semester		

PGC 603	Management and entrepreneurship	3
PGC 601	Research methodology and application of ICT in research	3
ZEB 607	Seminar in animal genetics / molecular biology/ biotechnology	3
ZEB 690	Project report	6
Sub total		**15 units**
Total		**51 units**

Course Outline (Ph.D. Programmes)

Ph.D. (Parasitology and Public Health)

Course No	**Title**	**Units**
First Semester		
ZEB 721	Advances in protozoan, molluscan and arthropod borne diseases	3
ZEB 723	Advances in helminthology	3
ZEB 783	Advanced seminar in parasitology and public health I	3
Sub total		**9 units**
Second Semester		
ZEB 722	Advances in epidemiology, public health and control of parasitic diseases	3
ZEB 724	Advances in immunology of parasitic diseases	3
ZEB 784	Advanced seminar in parasitology and public health II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3
ZEB 790	Thesis	12
Sub total		**18 units**
Total		**36 units**

Ph.D. (Entomology and Forensic Sciences)

Course No	**Title**	**Units**
First Semester		
ZEB 731	Advanced forensic entomology	3
ZEB 733	Advanced stored products entomology	3
ZEB 785	Advanced seminar in entomology/forensic science I	3
Sub total		**9 units**
Second Semester		
ZEB 732	Advances in insect physiology and biochemistry	3
ZEB 734	Advances in insects ecology	3
ZEB 786	Advanced seminar in entomology/forensic science II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3
ZEB 790	Thesis	12
Sub Total		**18 units**
Total		**36 units**

Ph.D. (Fishery Science and Aquaculture)

Course No	**Title**	**Units**
First Semester		
ZEB 741	Advances in fish and fishery biology	3

ZEB 743	Advances in aquaculture	3
ZEB 787	Advanced seminar fisheries and aquaculture I	3
Sub total		**9 units**
Second Semester		
ZEB 742	Advances in environmental impact assessment	3
ZEB 744	Advances in fishing technology	3
ZEB 788	Advanced seminar fisheries and aquaculture II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3
ZEB 790	Thesis	12
Sub total		**18 units**
Total		**36 units**

Ph.D. (Animal Ecology and Environmental Biology)

Course No	**Title**	**Units**
First Semester		
ZEB 751	Advances in ecology	3
ZEB 753	Advances in environmental biology	3
ZEB 755	Advances in ecotoxicology and environmental safety	3
ZEB 701	Advanced seminar in animal ecology/environmental biology I	3
Sub total		**12 Units**
Second Semester		
ZEB 742	Advances in environmental impact assessment	3
ZEB 752	Advances in ecosystem management	3
ZEB 704	Advanced seminar in animal ecology/environmental biology II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3
ZEB 790	Thesis	12
Sub total		**18 units**
Total		**39 units**

Ph.D. (Hydrobiology/Aquatic Sciences)

Course No	**Title**	**Units**
First Semester		
ZEB 741	Advances in fish and fishery biology	3
ZEB 761	Advances in the management of freshwater resources	3
ZEB 763	Ecobiology of aquatic insects	3
ZEB 780	Advanced seminar in hydrobiology/aquatic sciences I	3
Sub total		**12 Units**
Second Semester		
ZEB 742	Advances in environmental impact assessment	3
ZEB 762	Advances in limnology	3
ZEB 702	Advanced seminar in hydrobiology/aquatic sciences II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3

ZEB 790	Thesis	12
Sub total		**18 units**
Total		**39 units**

Ph.D. (Animal Genetics, Molecular Biology and Biotechnology)

Course No	**Title**	**Units**
First Semester		
ZEB 771	Advances in animal molecular biology	3
ZEB 773	Advances in animal biotechnology	3
ZEB 775	Advances in animal genetics	3
ZEB 703	Advanced seminar in animal genetics / molecular biology/ biotechnology I	3
Sub total		**12 Units**
Second Semester		
ZEB 772	Advances in animal breeding	3
ZEB 774	Advances in bioinformatics	3
ZEB 706	Advanced seminar in animal genetics / molecular biology/ biotechnology II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3
ZEB 790	Thesis	12
Sub total		**18 units**
Total		**39 units**

Ph.D. (Animal and Environmental Physiology)

Course No	**Title**	**Units**
First Semester		
ZEB 711	Advances in cell physiology	3
ZEB 713	Advances in environmental physiology	3
ZEB 781	Advanced seminar in animal and environmental physiology I	3
Sub total		**9 units**
Second Semester		
ZEB 712	Advances in organismal physiology	3
ZEB 714	Advances in stress physiology	3
ZEB 782	Advanced seminar in animal and environmental physiology II	3
Sub total		**9 units**
Third Semester		
PGC 701	Synopsis and research grant writing	3
PGC 703	Advanced research methodology and application of ICT in research	3
ZEB 790	Thesis	12
Sub Total		**18 units**
Total		**36 units**

Course Descriptions

PGC 601: Research methodology and application of ICT in research [3 units]
In-depth research work aimed at acquiring full knowledge and presentations in scholarly writing of the concepts, issues, trends in the definition and development of the study area from African and Western perspectives. Major steps in research: selection of problem, literature review, design, data collection, analysis and interpretation, conclusions. Study of various research designs, historical, case studies, survey, descriptive, cross sectional, experimental, etc. Analysis, surveys and synthesis of

conceptual and philosophical foundations of different disciplines. Identification of research problems and development of research questions and or hypotheses. Detailed treatment of methods of collecting relevant research data and the format for presenting research results (from designing the table of contents to referencing, bibliography and appendix). Data analysis and result presentation in different disciplines using appropriate analytical tools. Methods of project/ dissertation writing. Application of appropriate advanced ICT tools relevant in every discipline for data gathering, analysis, and result presentation. Essentials of spreadsheets, internet technology, internet search engines, statistical packages, precision and accuracy of estimates, principles of scientific research, concepts of hypothesis formulation and testing, organization of research and report writing. All registered Masters Degree students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

PGC 603: Management and entrepreneurship [3 units]
Business environment, general management, financial management entrepreneurship development, feasibility studies, marketing and managerial problem solving.

PGC 701: Synopsis and research grant writing [3 units]
Identification of types and nature of grant and grant writing; mining of grant application calls on the internet. Determining appropriate strategy for each grant application. Study of various grant applications structures and contents and writing of concept notes, detailed project description, budgeting and budget defense. Project justification, review of critical problems, principles of scientific research, concepts of hypothesis formulation and testing, aims and objectives, essentials of literature review, methodology, experimental design, SWOT analysis, work plan, budgeting, expected outcome, beneficiary, cost benefit analysis, overall contributions to society. Study of sample grants writings in various forms and writing of mock research and other grants. Identification of University of Nigeria synopsis structure and requirements (Introduction, methodology and results). Determining the content of each subunit of the synopsis. Steps in the writing of the synopsis from project report/dissertation/thesis. Structural and language issues. Common errors in synopsis writing and how to avoid them. The role of the student and the supervisor in the production of the synopsis. Writing of mock synopsis. All registered Ph.D students must attend a solution-based interactive workshop to be organized by the School of Postgraduate Studies for a practical demonstration and application of the knowledge acquired from the course, conducted by selected experts.

PGC 703: Advanced Research methodology and application of ICT in research [3 units]
Advanced courses on essentials of spreadsheets, internet technology, statistical packages, precision and accuracy of estimates, principles of scientific research, concepts of hypothesis formulation and testing, organization of research and report writing.

ZEB 602: Bioinformatics [3 units]
Introduction to Bioinformatics, scripting, use of computer programmes, programme installation and navigation, data mining, statistical analysis, primer design, sequence analysis, BLAST, phylogenetic analysis, genomics. Internet studies- world wide web, HTML and URL, Search engines, PubMed and information retrieval, MeSH vocabulary, Sequence Information Sources-EMBL nucleotide sequence data base, Genbank overview, Entrez, LotusLink, UniGene; Protein synthesis and information sources, Protein Sequence and phylogeny analysis, protein alignment, etc Genome, nucleotides and Polynucleotide, Base Paring, DNA ,RNA, genetic code, Homology.

ZEB 607: Seminar in animal genetics / molecular biology/ biotechnology

Recent advances in animal genetics / molecular biology/ biotechnology or specific problems in animal genetics / molecular biology/ biotechnology; this involves a critical review of current and relevant literatures in specific areas of animal genetics / molecular biology/ biotechnology. Each student is expected to write and make an oral presentation on a topic in animal genetics / molecular biology/ biotechnology and must participate in all departmental seminars.

ZEB 611: Research techniques in physiology [3 units]
Application of biological, chemical and physical techniques in physiological research, histological, cyto- and histochemical methods including bioassays and techniques, chromatography and electrophoresis, osmometry, spectroscopy and related instrumentation, endocrinological methods and the use of electronic monitoring devices.

ZEB 612: Environmental physiology [3 units]
Limiting effects of environmental factors on vital functions and the appropriate compensatory mechanism, Elimination of waters and chemical regulation, water relations and osmotic balance, mechanisms of responses to thermal stress, special physiological adaptations to aquatic and terrestrial environments.

ZEB 613: Advanced comparative physiology [3 units]
Dietary factors and nutrition, comparative physiology and biochemistry of respiration, bioenergetics, cardio-vascular function, excitability, mechanical and specialized activity, growth patterns and laws (including elements of biometry), reproductive physiology.

ZEB 614: Organismal physiology [3 units]
Receptor and effector mechanisms, specialized responses and their coordinating functions, neuro-muscular mechanisms, Endocrine control for vital processes.

ZEB 615: Cell physiology [3 units]
Ultra-structure and function of cell components, Biological macromolecules, Enzymes, Energy relations in cells, salt and water relations in cells, Active transport and membrane phenomena, Mechanical activity and cellular motion, cell secretion.

ZEB 616: Advanced respiratory physiology and diseases [3 units]
Respiratory system and mechanisms, pathophysiology of lung diseases, physiology of the lung and heart, chronic obstructive pulmonary disease (COPD), air narrowing and immune responses, acute lung injury, pulmonary fibrosis, viral infections, genetics of respiratory diseases, methods for rehabilitation of respiratory disorders.

ZEB 617: Physiology of stress and stress management [3 units]
Concept of stress and stress physiology, pathways of stress physiology, pathophysiology and neurobiology of stress, roles of endocrine and immune systems in stress, stress responses and adaptation, stress management.

ZEB 618: Advanced reproductive physiology and diseases [3 units]
Concepts of and mechanisms of reproduction, reproductive systems in man, reproductive tract infections, reproductive tract disorders, reproductive health and environment, management of reproductive diseases.

ZEB 619: Advanced gastrointestinal physiology and diseases [3 units]
Histology and functional mechanism of gastrointestinal (GI) system, pathogenesis of gastrointestinal disorders, symptoms of gastrointestinal disorder, inflammatory bowel disease, constipation,

diarrhea, infectious gastrointestinal problems, acid peptic disease, ischemic disease and other, malignancy, management of gastrointestinal disorders

ZEB 620: Vector biology, control and climate change [3 units]
Public health importance of vector-borne disease prevention, integrated pest management, vector-borne diseases of public health importance, control methods for rodents, mosquitoes, and ticks, bed bug biology, control, and interactive inspection, vectors as bioterrorism agents, pesticides and "green" pest control, housing and lodging pests, food service pests, global climate change, identify vector-borne diseases as bioterrorism agents, impact of climate change to geographic movement of vectors.

ZEB 621: Research techniques in parasitology and public health [3 units]
Laboratory and field procedures in parasitology including sampling and examination of external and internal environments for parasites, classification and measurements, statistical packages/softwares and analysis of research data, preparation of figures, microphotography, micro-techniques, cytological and histochemical techniques as tools for parasitological research, immunological techniques including complement fixation, *in vitro* techniques.

ZEB 622: Advanced helminthology (with emphasis on transmission and diseases of helminth parasites) [3 units]
Directed comprehensive study of aspects of taxonomy, phylogeny, functional anatomy, infective mechanisms, and life history of fluke, cestodes, spiny-headed worms, roundworms and leaches, helminthiasis and their control, helminth parasites of medical and veterinary importance, including life history of parasites, food and vector-borne parasitic infections, type of diseases caused by helminth parasites, the role of host behavoiur in parasitic helminth transmission, circadian rhythms in the transmission of helminth parasites (filarial periodicity), control strategies.

ZEB 623: Principles, concepts and problems in parasitology and public health [3 units]
Tutorials on topics such as parasitism, host-parasite relations, transmission of parasites immunity pathology of parasite infections, current problems in helminthological research, hetero-specific associations among animals, types of parasitism, parasites and their hosts, the effects of parasitism on the parasite and host, distribution of parasites in a host population, factors influencing parasite density and distribution, host-parasites specificity; the species problem and the evolution of parasitism in the animal kingdom.

ZEB 624: Comparative physiology and biochemistry of parasites [3 units]
Chemical composition, water relations, nutrition, respiration, carbohydrate, protein, and fat metabolism of both adult and larval stages, the parasite integument, problems of *in-vitro* cultivation of endoparasites, chemical immunological phenomena, habitat and physicochemical requirements, nutrition, absorption, energy stores, energy metabolism in parasitic protozoa and helminthes, purine and pyrimidine biosynthesis, amino acid metabolism and membrane biology in parasitic protozoa and helminthes, moulting, arrested development, self cure phenomena, parasitic adaptations and propagation of parasites, ultra-structure of parasites and its relationship to physiological processes.

ZEB 625: Diseases of protozoan parasites and arthropods [3 units]
Aspects of the taxonomy, phylogeny, functional morphology, infective mechanism and life history, basic problem of parasitism in the groups, protozoal and arthropodal diseases and their control, parasitic protozoa of medical and veterinary importance, transmission patterns and types of diseases caused by protozoan parasites in the tropics, the role of vectors in the transmission of protozoan diseases, the role of host behaviour in the transmission of protozoan parasites.

ZEB 626: Epidemiology and public health and control of parasitic diseases in the tropics [3 units]
Introduction to the principles and methods of epidemiology, types of epidemiological surveys (descriptive, experimental and analytical), patterns of disease occurrence in the tropics, measurement of parasitic infections in a host population, epidemiology and recent developments in the control of major parasitic diseases and their vectors in tropical Africa, ethical consideration in epidemiological studies, the socio-economic and biological basis of transmission of parasite diseases, principles of cost benefit analysis in health planning, the practical work will include in-depth and comparative studies of rural and urban communities, a detailed examination of endemic parasitic disease of Nigeria selected from the following list; malaria, trypanosomiasis, filariasis, onchocerciasis, schistosomiasis, hookworm morbidity, dracunculiasis, etc.

ZEB 627: Parasite genetic resources and climate change [3 units]
Genetic resources of parasites, effect of climate on emerging parasites and parasitic diseases, adaptation of parasite to climate change, changing patterns of parasitic diseases, development of resistant parasite species, climate change impacts on infectious diseases, seasonal patterns of parasites and parasitic diseases.

ZEB 628: Immunology of parasitic diseases [3 units]
Basic concepts; natural and acquired immunity, cell types in immune systems; immunity to parasites (protozoa and helminths), evasion of host immune response; advances in immunization against parasitic infections, immunological methods, scope of immunology, antigens and antibodies, the host as environment, natural and acquired resistance to parasitic immunity, antibody specificity, immune response to invading organisms, lymphocytes, antibody production and the immunoglobulin, recognition of antigens, antigenic variation and initiation of immune response, cell mediated and acquired immune response, immunity to protozoa and helminths vaccines.

ZEB 629: Climate change and public health [3 units]
Impacts from heat waves, impacts from extreme weather events, impacts from reduced air quality, increases in ozone, changes in fine particulate matter, changes in allergens, impacts from climate-sensitive diseases, food-borne diseases, water-borne diseases, animal-borne diseases, emerging diseases, introduction of diseases into new environments, parasite-host interactions in a changing environment, mitigation and adaptation issues in climate change and public health.

ZEB 630: Insect biodiversity, evolution and climate change [3 units]
Population dynamics of insect populations and communities, species diversity and structure, insect ecology, behavior, impacts of a changing climate, linkage between insect and environment, ecological and evolutionary responses to recent climate change.

ZEB 631: Research techniques in entomology and forensic sciences [3 units]
Collection and handing of various stages of insects from soil, plant-materials, bodies of water, air, other animals and homes, identification, processing of microscope and physiological preparation, special techniques in culturing, breeding and preservation of insects, research techniques in computational and digital forensics, anthropology, archaeology, botany and biochemical forensics, dactyloscopy, DNA analysis, paternity/maternity testing, entomology, intelligence and Interviews, meteorology, odontology, pathology, podiatry, serology, micro-spectrophotometry, wildlife, blood spatter analysis, bibliography and writing of research paper reports in entomology and forensic sciences.

ZEB 632: Pesticide ecobiology [3 units]

Organic and inorganic pesticides, biopesticides, recognition/appreciation, uses, chemistry, mode of action, field application of pesticides, insecticides and other pesticides to environment stimuli, pesticide resistance, pesticide and target and non-target organisms, pesticide and environment.

ZEB 633: Arthropod taxonomy (emphasis on insects and arachnids) [3 units]
General entomology, systematic and biology of acarina and major insect order with emphasis on groups of economic importance, study of advanced principles and methods of insect classification, construction and use of keys, techniques for the collection and preservation of insects.

ZEB 634: Advanced insect physiology and biochemistry [3 units]
Critical survey of recent trends in insect physiology, particularly the integument, nutrition, metabolism and responses to environmental stimuli, study of relevant aspects of the genetics, physiology and biochemistry of insects, current techniques in insect physiology, the insect integument, digestion, excretion, water and temperature relations and ionic regulation, respiration, circulation, energetics, reproduction, growth and development, physiological properties of insect muscles, nervous systems and sense organs, insect haemolymph, hormones and pheromones, integrated control of insect pests including the physiology of insecticide resistance.

ZEB 635: Medical, veterinary and forensic entomology [3 units]
A study of the biology, distribution, control and economic significance of arthropods of medical and veterinary importance in Nigeria and the West African sub-region, control programmes of tsetse fly, mosquitoes, blackflies, etc. urban, stored-product, and medico-legal forensic entomology, insect types in forensic entomology; blood-feeding (haematophagous) insects, necrophagous insects, flies, beetles, mites, moths, wasps, ants, and bees, factors considered in forensic entomology; moisture levels, bodies of water, sun exposure, air exposure, geography, weather, modern techniques in forensic entomology; scanning electron microscopy, potassium permanganate staining, mitochondrial DNA analysis, mock crime scenes, gene expression studies, insect activity case study, open field habitat, coastal sand-dune habitat, native bush habitat, etc.

ZEB 636: Management of harmful insects [3 units]
Biology of selected insects harmful to man and his activities, methods of control and current practice of management of such pests, theories of natural control of insect pests, the role of bird, fishes, amphibians, small mammals and other agents, integrated pest management (IPM).

ZEB 637: Insect ecology and forensic sciences [3 units]
Detailed studies geared mainly to field/laboratory observations on insects and acarina of economic importance, general principles of insect ecology, insect populations and the effects of environmental factors-temperature, relative humidity, rainfall, wind, etc, the ecology of pest control, including biological control, insect community studies, intra-and inter-specific competition and dispersal; prey-predator interaction and strategies, life table and key factor studies in insect natural populations. Principles, scope and nature of forensic science, insects and crime.

ZEB 638: Economic entomology and human welfare [3 units]
Harmful insects; pest of crops; stored products; vectors of human and animal diseases, nuisance to human and environment, poisonous insects. Beneficial insects; agriculture, apiculture, entomophagy, industrial, sericulture, lac production, maggots, medical, insect and man, etc.

ZEB 639: Stored products entomology [3 units]
Bio-taxonomy and ecology of insect pests of crops and stored products in the tropics, with particular emphasis on West Africa, techniques for screening stored products for infestation, prediction of pest

outbreaks, chemistry of pesticide action, principles and techniques of pest control for arable crops, plantation crops and stored products, management of stored products.

ZEB 640: Climate change and fishing communities [3 units]
Impacts of climate change on fish habitats, such as coral reefs, fin and shell fish resources, climate change impact on coastal communities depending on fisheries, impact on small scale fisheries, impact on artisanal and industrial fisheries, impact on fish processing, preservation and marketing, impact on fish cooperatives.

ZEB 641: Research techniques in fishery science and aquaculture [3 units]
Procedures in fish and fisheries biology including experimental designs (laboratory and field experiments) measurement, tagging operations, methods of study of life history, food and feeding habits, reproduction, age, growth and population, fish parasite collection and identification, disease diagnosis and treatment, genetically modified fish, fish seed technology, fish feed technology, pond designs and construction, physicochemical parameters of ponds and rivers, processing and analysis of data, statistical packages (FISHSAT, SPSS etc).

ZEB 642: Fisheries and aquaculture management [3 units]
Comparative and distribution of world fisheries with particular reference to the tropics, survey and comparison of techniques of conservation/management of fish stocks in natural and artificial habits including populations problems of commercial and game fisheries, fish pest and diseases, fish pond dynamics and management.

ZEB 643: Advanced biology of fishes [3 units]
A comprehensive survey of fish anatomy, morphology, phylogeny, life histories, biology, behavior of living fishes from cyclostomes to osteichthyes, current techniques in fish physiology, the fish integument, digestion, excretion, water and temperature and ionic regulation, respiration, circulation, energetics, physiological properties of fish muscles, nervous systems and sense organs, fish hormones, taxonomy of major groups and the communities of selected tropical fishes, food and feeding habits of fish species, identification of gut contents, age and growth determinations, reproduction, breeding and life cycles, prey-predator relationships, population studies, recruitment and mortality, fish migration, territorial behaviour and schooling.

ZEB 644: Fisheries and fishing technology [3 units]
Comparative study of fish handing, preparation/processing, preservation, fish by-products, fish distribution, gear and craft technology, fishing methods, evolution of fishing methods, trawls, nets, gears and gear types, fish location gadgets, fish feed technology, composition, preparation, evaluation and types, construction of fish holding structures/systems, field practical work in collaboration with public and private fisheries establishment, assessment of fish quality, etc.

ZEB 645: Tropical aquaculture [3 units]
Dams and pond construction, stocking and pond management, cropping and marketing, cage culture, raceways and closed circulation systems, fish propagation, controlled natural and induced spawning, hatchery organization and management, feed formulation and evaluation, culture of shell fishes, polyculture, monoculture, sea ranching, semi intensive, intensive, super intensive fish culture.

ZEB 646: Environmental impact assessment [3 units]
Basic concepts, principles and history of environmental impact assessment (EIA), relationship between EIA and environmental impact statement (EIS), indicator species and organisms of value in environmental assessment, Essentials in EIA, potential problems of EIA and their solutions, cost

benefits as a tool for environmental decision-making, field case studies of impact assessment in Nigeria.

ZEB 647: Climate change and fish production [3 units]
Role of oceans, freshwaters, ponds and watersheds in fish production, impact of climate change on fish production, impact of climate change on fishing communities, adaptation and mitigation.

ZEB 648: Fisheries genetic resources and climate change [3 units]
Climate change stressors in aquatic ecosystem, short-term fluctuations, seasonal patterns of climate change on fisheries, impacts on fisheries, aquatic genetic resources and adaptation to climate change, implications of climate change for aquaculture and fisheries, roles of aquatic resources for adaptation and mitigation.

ZEB 651: Ecological methods [3 units]
Advanced techniques/procedures in aquatic, terrestrial and aerial ecology, advanced techniques/procedures/ methods in environmental budgeting/audit, ecotoxicology, and environmental health biology.

ZEB 652: Advanced animal ecology [3 units]
Population and community ecology, population dynamics, tropical relations, ecological energetics, ecological productivity, tropical habitats, microecology, limiting factors, recent advances in zoogeography, applied ecology, pollution and radiation ecology.

ZEB 653: Ecotoxicology and environmental safety [3 units]
Sources of exposure to toxins, natural and man-made toxins, toxins in the Nigerian environment, bioassay for ecotoxins, resistance and evaluation of toxicity, radiation biology, principle, rules and regulations of environmental safety, environmental safety gadgets.

ZEB 654: Ecology of tropical ecosystems [3 units]
Intensive studies of the factors affecting the abundance and distribution of animals in tropical terrestrial ecosystems (lowland forests, savanna, deserts and mountain systems), community structure, functions and dynamics, adaptation of animals to different tropical environments and the effect of human activities on tropical ecosystems, ecology of coastal and tropical inland waters like estuaries, lagoons, rivers, natural and artificial lakes, the inter-relationships of fauna and flora, man's influences on the aquatic environment.

ZEB 655: Wildlife conservation, games and park management [3 units]
Wildlife in relation to their environment, factors affecting the distribution and abundance of wildlife, inter-relationships between climate, soils, vegetation, history and wildlife populations, the wildlife resources of Nigeria, movement, behaviour, life cycles, reproduction, food and food habits of wildlife, natural and efficient usage of range lands in Africa, methods of range assessment and management, principles of biological conservation, natural reserves.

ZEB 656: Climate change and ecosystem [3 units]
Effect of climate change on terrestrial, aquatic and aboral ecosystems and biodiversity, habitat modification, ecological productivity, aquacultural and agricultural productivity, species migrations and life cycle events, invasive species, species extinction.

ZEB 657: Behavioural ecology [3 units]
Advanced studies of the adaptive value of social organization, territory, reproductive ecology, feeding ecology, predator/prey interactions and competition, case studies.

ZEB 658: Ecology and management of tropical wetlands [3 units]
Definition of wetlands important terms associated with wetlands, distribution of wetlands in Nigeria, ecology of wetlands, biology of wetland fauna, economics of wetlands, field studies.

ZEB 659 Ecosystem management [3 units]
Formulations of management policies, stakeholders and politics of ecosystem management, adaptive management, natural resource management, strategic management, landscape level conservation, command and control managements, ecosystem based fisheries, sustainable forest management, sustainable land management, agro-ecosystems and their management.

ZEB 661: Research techniques in aquatics ecosystem [3 units]
Laboratory and field training in the use and application of limnological methods-physical, chemical and biological, processing and analysis of limnological data.

ZEB 662: Aquatic resources [3 units]
Dynamics of aquatic resources, management of aquatic resources, theoretical considerations of primary and secondary energy budgets, factors affecting energy budgets.

ZEB 663: Aquatic insects [3 units]
Systematic and biology of major aquatic insect order with emphasis on groups of economic importance, advanced principles and methods of aquatic insect classification, construction and use of keys, techniques for the collection and preservation of insects, aquatic insect ecology.

ZEB 664: Advanced limnology [3 units]
Freshwater ecosystems, physical, chemical and biological characteristics of lakes and streams in relation to productivity with particular reference of the tropics.

ZEB 665: Management of freshwater resources [3 units]
Water management with particular reference to water abstraction in relation to maintenance of optimum levels of water quality for aquatic production purposes, artificial and natural water sources, water shed resources management/development including the problems, management of reservoirs and man-made lakes, water as major resources of recreation development.

ZEB 666: Aquatic resources and climatic change [3 units]
The effects of climate change on agriculture, land resources, water resources, physicochemical properties, and flora and fauna biodiversity, runoff, potable water resources, in-stream uses, industrial and thermoelectric power uses, socioeconomic impacts and policy implications.

ZEB 667: Climate change and communities exploiting aquatic resources [3 units]
Pollution, fragmentation of natural systems, over-exploitation of resources, the negative impacts of climate change on freshwater systems outweigh its impacts on many individual freshwater species, community composition and water quality, coastal areas sea level rise and water resource constraints, socio-economic impacts of climate change in coastal zones, most vulnerable communities, sources sustainable management, adaptations and mitigations of aquatic resources exploiters to climate change.

ZEB 668: Adaptation and mitigation issues in climate change and aquatic resources [3 units]
Climate change challenges for aquatic organisms, ecosystems, aquaculture, fish, culture-based fisheries, capture fisheries, aquatic genetic resources and adaptation to, and mitigation of climate change.

ZEB 671: Advanced animal molecular biology I [3 units]
Structural organization of chromosomes of prokaryotes and eukaryotes, advances of the eukaryotic chromosomes over the prokaryotic types. Evolution of thee eukaryotic chromosome type, cell division cycle; mitosis and meiosis, techniques in animal cytogenetics and karyotyping, physical and chemical properties of nucleic acids, gene expression and control; mutation and mutagenesis, transformation, modern trends in molecular genetics etc

ZEB 672: Advanced animal molecular biology II [3 units]
Significant of human genetics, problems of experimentation and data collection, mendelian genetics, deviations from mendelian ratios, cell division, nature of chromosomes, gene, DNA; protein synthesis, mutations, human Karyotype, criteria for autosomal sex linked inheritances, pedigree analysis, inherited homoglobinohties e.g. sickle cell anaemia; inherited enzymes defects- PKU, albinisms etc, human ABO systems, genetic counseling etc.

ZEB 673: Advanced animal biotechnology I [3 units]
Animal protein biotechnology and products, animals in biotechnology research, clones, creating Dolly, limits of cloning, future of cloning, transgenic animals; transgenic techniques, improving agro-aquaculture products with transgenics, transgenic animals as bioreactors, knock-out: a special case of transgenics, antibodies production in animals models, monoclonal antibodies, egg as antibody factories, DNA fingerprinting and forensic biotechnology, molecular genetics of aquatic animals, biomass and bio-processing, environmental animal biotechnology and bioremediation.

ZEB 674: Advanced animal biotechnology II [3 units]
Advances in medical biotechnology; biomarkers for disease detection, vaccines and therapeutic antibodies, detecting genetic diseases, gene therapy, cell and tissue transplanting, tissue engineering, stem cell technologies and cloning, embryonic stem cell and therapeutic cloning, human genomic project, gene banks, animal biotechnology regulations, inspections, EPA, food and drugs administration, legislation and regulations, patents, ethical issues in biotechnology, biotechnology and nature.

ZEB 675: Advanced animal genetics I [3 units]
Population genetics, Mendelian and quantitative genetics, gene and genotype frequencies and Hardy-Weinberg equilibrium, factors affecting genetic frequencies and natural populations, ecological genetics, coefficients of natural/artificial selection, gene polymorphism, population growth and limitations, genetics in animal breeding, cross breeding programmes to investigate quantitative characters, etc.

ZEB 676: Advanced animal genetics II [3 units]
Immunogenetics, molecular genetics and functional genomics of economically important and domesticated animals, variability at gene and protein levels, mapping of gene, traits and QTL, associations between genes and traits, genetic diversity and types, and characterization of gene expression and control.

ZEB 677: Research techniques in animal genetics / molecular biology/ biotechnology [3 units]
Application of biological, chemical and physical techniques in animal genetics / molecular biology/ biotechnology research, histological, cytological and histochemical methods including bioassays and techniques, chromatography and electrophoresis, PCR, karyotyping, osmometry, spectroscopy and related instrumentation, endocrinological methods and the use of electronic monitoring devices.

ZEB 679: Animal breeding and genetics [3 units]
Breeding, rearing and genetic composition of small animals, population dynamics of small animals, Limitations of small animal production-energy and increased labour requirements, diseases,

predations, legal and administrative restrictions; production systems of small animals e.g. insects (termites, maggots, drosophila, honey bee), molluscs (freshwater and land snails, mussels), rodents (giant rats, grass cutters, guinea pigs,), small mammals (duikers, musk deer, other small antelopes), reptiles, etc.

ZEB 680: Seminar in hydrobiology/aquatic sciences [3 units]
Recent advances in limnology and specific problems of tropical freshwater. Current problems in limnology and aquatic resources management, this involves a critical review of current and relevant literatures in specific areas of hydrobiology/aquatic science. Each student is expected to write and make an oral presentation on a topic in hydrobiology/aquatic science and must participate in all departmental seminars.

ZEB 681: Physiology seminar [3 units]
Current problems in animal and environmental physiology will be addressed; this involves a critical review of current and relevant literatures in specific area of animal and environmental physiology. Each student is expected to write and make an oral presentation on a topic in animal and environmental physiology and must participate in all departmental seminars.

ZEB 683: Parasitology and public health seminar [3 units]
Current problems in parasitology and public health, this involves a critical review of current and relevant literatures in specific areas of parasitology and public health. Each student is expected to write and make an oral presentation on a topic in parasitology and public health and must participate in all departmental seminars.

ZEB 685: Entomology / forensic sciences seminar [3 units]
Current problems in entomology and forensic science, this involves a critical review of current and relevant literatures in specific areas of entomology and forensic Science. Each student is expected to write and make an oral presentation on a topic in entomology and forensic science and must participate in all departmental seminars.

ZEB 687: Fisheries and aquaculture seminar [3 units]
Current problems in fisheries development and management, this involves a critical review of current and relevant literatures in specific areas of fishery science and aquaculture. Each student is expected to write and make an oral presentation on a topic in fisheries sciences and must participate in all departmental seminars.

ZEB 689: Seminar in ecology/environmental biology [3 units]
Current problems in ecology/environmental biology, this involves a critical review of current and relevant literatures in specific areas of ecology/environmental biology. Each student is expected to write and make an oral presentation on a topic in fisheries sciences and must participate in all departmental seminars.

ZEB 690: Project report [6 units]
The project report must address field and/or laboratory study in the candidates area of specialization. A proposal, progress and final result seminars are mandatory. The research must be focused and contributes to solving of specific societal and/or environmental problems. Furthermore it must contribute significantly to the advancement of knowledge in the subject area. The output of such research should be publishable in top impact factor ranked journals.

ZEB 701: Advanced seminar in animal ecology/environmental biology I [3 units]

Current problems and recent advances in animal ecology/environmental biology outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of animal ecology/environmental biology, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 702: Advanced seminar in hydrobiology/aquatic sciences II [3 units]
Current problems and recent advances in hydrobiology/aquatic sciences with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his/her chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 703: Advanced seminar in animal genetics / molecular biology/ biotechnology I [3 units]
Current problems and recent advances in animal genetics / molecular biology/ biotechnology outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of animal genetics / molecular biology/ biotechnology, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 704: Advanced seminar in animal ecology/environmental biology II [3 units]
Current problems and recent advances in animal ecology/environmental biology with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his/her chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 706: Advanced seminar in animal genetics / molecular biology/ biotechnology II [3 units]
Current problems and recent advances in animal genetics / molecular biology/ biotechnology, with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his/her chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 711: Advances in cell physiology [3 units]
Current advances in cell physiology is reviewed from textbooks and journals with emphasis on ultra-structure and function of cell components, biological macromolecules, enzymes, energy relations in cells, salt and water relations in cells, active transport and membrane phenomena, mechanical activity and cellular motion, cell secretion.

ZEB 712: Advances in organismal physiology [3 units]
Current advances in organismal physiology is reviewed from textbooks and journals with emphasis on receptor and effector mechanisms, specialized responses and their coordinating functions, neuro-muscular mechanisms, endocrine control for vital processes.

ZEB 713: Advances in environmental physiology [3 units]

Current advances and trends in environmental physiology researches is reviewed from current textbooks and journals with emphasis on limiting effects of environmental factors on vital functions and the appropriate compensatory mechanism, elimination of waters and chemical regulation, water relations and osmotic balance, mechanisms of responses to thermal stress, special physiological adaptations to aquatic and terrestrial environments, etc.

ZEB 714: Advances in stress physiology [3 units]
Current advances and trends in stress physiology researches is reviewed from current textbooks and journals with emphasis on concept of stress and stress physiology, pathways of stress physiology, pathophysiology and neurobiology of stress, roles of endocrine and immune systems in stress, stress responses and adaptation, stress management.

ZEB 721: Advances in protozoan, molluscan and arthropod borne diseases [3 units]
Current advances and trends in protozoan, molluscan and arthropod borne diseases researches is reviewed from current textbooks and journals with emphasis on protozoa, molluscan and arthropod diseases and their control, parasitic protozoa of medical and veterinary importance, transmission patterns and types of diseases caused by protozoan, molluscan and arthropod parasites/vectors in the tropics, the role of vectors in the transmission of protozoan diseases, the role of host behaviour in the transmission of protozoan parasites.

ZEB 722: Advances in epidemiology, public health and control of parasitic diseases [3 units]
Current advances and trends in epidemiology, public health and control of parasitic diseases researches is reviewed from current textbooks and journals with emphasis on types of epidemiological surveys (descriptive, experimental and analytical), patterns of disease occurrence in the tropics, measurement of parasitic infections in a host population, epidemiology and recent developments in the control of major parasitic diseases and their vectors in tropical Africa, ethical consideration in epidemiological studies, the socio-economic and biological basis of transmission of parasite diseases, principles of cost benefit analysis in health planning, the practical work will include in-depth and comparative studies of rural and urban communities, a detailed examination of endemic parasitic disease of Nigeria selected from the following list; malaria, trypanosomiasis, filariasis, onchocerciasis, schistosomiasis, hookworm morbidity, dracunculiasis, etc.

ZEB 723: Advances in helminthology [3 units]
Current advances and trends in helminthology researches is reviewed from current textbooks and journals with emphasis on fluke, cestodes, spiny-headed worms, roundworms and leaches, helminthiasis and their control, helminth parasites of medical and veterinary importance, including life history of parasites, food and vector-borne parasitic infections, type of diseases caused by helminth parasites, the role of host behavoiur in parasitic helminth transmission, circadian rhythms in the transmission of helminth parasites (filarial periodicity), control strategies

ZEB 724: Advances in immunology of parasitic diseases [3 units]
Current advances and trends in immunology of parasitic diseases researches is reviewed from current textbooks and journals with emphasis on natural and acquired immunity, cell types in immune systems; immunity to parasites (protozoa and helminths), evasion of host immune response; advances in immunization against parasitic infections, immunological methods, scope of immunology, antigens and antibodies, the host as environment, natural and acquired resistance to parasitic immunity, antibody specificity, immune response to invading organisms, lymphocytes, antibody production and the immunoglobulin, recognition of antigens, antigenic variation and initiation of immune response, cell mediated and acquired immune response, immunity to protozoa and helminths vaccines.

ZEB 731: Advanced forensic entomology [3 units]
Current advances and trends in forensic entomology researches is reviewed from current textbooks and journals with emphasis on principles, scope and nature of forensic science, insects and crime, medico-legal forensic entomology, insect types in forensic entomology, factors considered in forensic entomology, modern techniques in forensic entomology, mock crime scenes, gene expression studies, insect activity case study, open field habitat, coastal sand-dune habitat, native bush habitat, etc.

ZEB 732: Advances in insect physiology and biochemistry [3 units]
Current advances and trends in insect physiology and biochemistry researches is reviewed from current textbooks and journals with emphasis on the physiology and biochemistry of the insects integument, nutrition, metabolism, responses to environmental stimuli, digestion, excretion, water and temperature relations and ionic regulation, respiration, circulation, energetics, reproduction, growth and development, physiological properties of insect muscles, nervous systems and sense organs, insect haemolymph, hormones and pheromones, integrated control of insect pests, physiology of insecticide resistance.

ZEB 733: Advanced stored products entomology [3 units]
Current advances and trends in stored products entomology researches is reviewed from current textbooks and journals with emphasis on techniques for screening stored products for infestation, prediction of pest outbreaks, chemistry of pesticide action, principles and techniques of pest control for arable crops, plantation crops and stored products, management of stored products.

ZEB 734: Advances in insect ecology [3 units]
Current advances and trends in insect ecology researches is reviewed from current textbooks and journals with emphasis on insect populations, effects of environmental factors on insect population, ecology of pest control, including biological control, insect community studies, intra-and inter-specific competition, dispersal, prey-predator interaction, life table and key factor studies in insect natural populations.

ZEB 741: Advances in fish and fishery biology [3 units]
Current advances and trends in fishery biology researches is reviewed from current textbooks and journals with emphasis on fish anatomy, morphology, phylogeny, behavior of living fishes from cyclostomes to osteichthyes, current techniques in fish physiology, the fish integument, digestion, excretion, water and temperature and ionic regulation, respiration, circulation, energetics, physiological properties of fish muscles, nervous systems and sense organs, fish hormones, taxonomy of major groups and the communities of selected tropical fishes, food and feeding habits of fish species, identification of gut contents, age and growth determinations, reproduction, breeding and life cycles, prey-predator relationships, population studies, recruitment and mortality, fish migration, territorial behaviour and schooling, fishery management, aquatic ecosystem, fishers cooperatives, issues in fishery management.

ZEB 742: Advances in environmental impact assessment [3 units]
Current advances and trends in environmental impact assessment researches is reviewed from current textbooks and journals with emphasis on relationship between EIA and environmental impact statement (EIS), indicator species and organisms of value in environmental assessment, essentials in EIA, potential problems of EIA and their solutions, cost benefits as a tool for environmental decision-making, field case studies of impact assessment in Nigeria.

ZEB 743: Advances in aquaculture [3 units]

Current advances and trends in aquaculture researches is reviewed from current textbooks and journals with emphasis on dam and pond construction, stocking, pond management, cropping, marketing, cage culture, raceways, open and closed circulation systems, fish propagation, controlled natural and induced spawning, hatchery technology, feed and feeding technology, shellfish culture, monoculture, polyculture, sea ranching, semi intensive, intensive, super intensive fish culture.

ZEB 744: Advances in fishing technology [3 units]
Current advances and trends in fishing technology researches is reviewed from current textbooks and journals with emphasis on fishing gear technology, active fishing, passive fishing, hook gears, net gears, traps, trawl nets and trawlers, post harvest technology.

ZEB 751: Advances in ecology [3 units]
Current advances and trends in ecology researches is reviewed from current textbooks and journals with emphasis on population and community ecology, population dynamics, tropical relations, ecological energetics, ecological productivity, tropical habitats, microecology, limiting factors, recent advances in zoogeography, applied ecology, pollution and radiation ecology.

ZEB 752: Advances in ecosystem management [3 units]
Current advances and trends in ecology researches is reviewed from current textbooks and journals with emphasis on formulations of management policies, stakeholders and politics of ecosystem management, adaptive management, natural resource management, strategic management, landscape level conservation, command and control managements, ecosystem based fisheries, sustainable forest management, sustainable land management, agro-ecosystems and their management.

ZEB 753: Advances in environmental biology [3 units]
Current advances and trends in ecology researches is reviewed from current textbooks and journals with emphasis on environmental modeling, ecological sanitation, environmental movement, environmental impact statement, environmental monitoring, environmental planning, environmental statistics, environmental informatics, issues in the earth summit, freshwater environmental quality parameters, terrestrial environmental quality parameters, natural landscape, environmental site assessment, sustainable development, agroecosystem management, pollution, environmental health, environmental degradation, etc.

ZEB 755: Advances in ecotoxicology and environmental safety [3 units]
Current advances and trends in ecology researches is reviewed from current textbooks and journals with emphasis on sources of exposure to toxins, natural and man-made toxins, toxins in the Nigerian environment, bioassay for ecotoxins, resistance and evaluation of toxicity, radiation biology, principle, rules and regulations of environmental safety, environmental safety gadgets.

ZEB 761: Advances in the management of freshwater resources [3 units]
Current advances and trends in management of freshwater resources researches is reviewed from current textbooks and journals with emphasis on water abstraction in relation to maintenance of optimum levels of water quality for aquatic production purposes, artificial and natural water sources, water shed resources management/development including the problems, management of reservoirs and man-made lakes, water as major resources of recreation development.

ZEB 762: Advances in limnology [3 units]
Current advances and trends in limnology researches is reviewed from current textbooks and journals with emphasis on freshwater ecosystems, physical, chemical and biological characteristics of lakes and streams in relation to their productivity in the tropics.

ZEB 763: Ecobiology of aquatic insects [3 units]
Current advances and trends in aquatic insects researches is reviewed from current textbooks and journals with emphasis on biology of major aquatic insect, economic importance, advanced principles and methods of aquatic insect classification, construction and use of keys, techniques for the collection and preservation of insects, aquatic insect ecology.

ZEB 771: Advances in animal molecular biology [3 units]
Current advances and trends in animal molecular biology researches is reviewed from current textbooks and journals with emphasis on structural organization of chromosomes of prokarytes and eukaryotes, advances of the eukaryotic chromosomes over the prokaryotic types. Evolution of thee eukaryotic chromosome type, cell division cycle; mitosis and meiosis, techniques in animal cytogenetics and karyotyping, physical and chemical properties of nucleic acids, gene expression and control; mutation and mutagenesis, transformation, modern trends in molecular genetics, significant of human genetics, problems of experimentation and data collection, mendelian genetics, deviations from mendelian ratios, cell division, nature of chromosomes, gene, DNA; protein synthesis, mutations, human Karyotype, criteria for autosomal sex linked inheritances, pedigree analysis, inherited homoglobinohties e.g. sickle cell anaemia; inherited enzymes defects- PKU, albinisms etc, human ABO systems, genetic counseling etc.

ZEB 772: Advances in animal breeding [3 units]
Current advances and trends in animal breeding researches is reviewed from current textbooks and journals with emphasis on breeding, rearing and genetic composition of small animals, population dynamics of small animals, limitations to small animal production, energy and increased labour requirements, diseases, predations, legal and administrative restrictions, production systems for small animals e.g. insects (termites, maggots, drosophila, honey bee), molluscs (freshwater and land snails, mussels), rodents (giant rats, grass cutters, guinea pigs,), small mammals (duikers, musk deer, other small antelopes), reptiles (crocodiles, snakes and lizards).

ZEB 773: Advances in animal biotechnology [3 units]
Current advances and trends in animal biotechnology researches is reviewed from current textbooks and journals with emphasis on animal protein biotechnology and products, animals in biotechnology research, clones, creating Dolly, limits of cloning, future of cloning, transgenic animals; transgenic techniques, improving agro-aquaculture products with transgenics, transgenic animals as bioreactors, knock-out: a special case of transgenics, antibodies production in animals models, monoclonal antibodies, egg as antibody factories, DNA fingerprinting and forensic biotechnology, molecular genetics of aquatic animals, biomass and bio-processing, environmental animal biotechnology and bioremediation. Advances in medical biotechnology; biomarkers for disease detection, vaccines and therapeutic antibodies, detecting genetic diseases, gene therapy, cell and tissue transplanting, tissue engineering, stem cell technologies and cloning, embryonic stem cell and therapeutic cloning, human genomic project, gene banks, animal biotechnology regulations, inspections, EPA, food and drugs administration, legislation and regulations, patents, ethical issues in biotechnology, biotechnology and nature.

ZEB 774: Advances in bioinformatics [3 units]
Current advances and trends in bioinformatics researches is reviewed from current textbooks and journals with emphasis on scripting, use of computer programmes, programme installation and navigation, data mining, statistical analysis, primer design, sequence analysis, BLAST, phylogenetic analysis, genomics. Internet studies- world wide web, HTML and URL, Search engines, PubMed and information retrieval, MeSH vocabulary, Sequence Information Sources-EMBL nucleotide sequence data base, Genbank overview, Entrez, LotusLink, UniGene; Protein synthesis and information

sources, Protein Sequence and phylogeny analysis, protein alignment, etc Genome, nucleotides and Polynucleotide, Base Paring, DNA ,RNA, genetic code, Homology.

ZEB 775: Advances in animal genetics [3 units]
Current advances and trends in animal genetics researches is reviewed from current textbooks and journals with emphasis on population genetics, Mendelian and quantitative genetics, gene and genotype frequencies and Hardy-Weinberg equilibrium, factors affecting genetic frequencies and natural populations, ecological genetics, coefficients of natural/artificial selection, gene polymorphism, population growth and limitations, genetics in animal breeding, cross breeding programmes to investigate quantitative characters, Immunogenetics, molecular genetics and functional genomics of economically important and domesticated animals, variability at gene and protein levels, mapping of gene, traits and QTL, associations between genes and traits, genetic diversity and types, and characterization of gene expression and control.

ZEB 780: Advanced seminar in hydrobiology/aquatic sciences I [3 units]
Current problems and recent advances in hydrobiology/aquatic sciences outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of hydrobiology/aquatic sciences, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 781: Advanced seminar in animal and environmental physiology I [3 units]
Current problems and recent advances in animal and environmental physiology outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of animal and environmental physiology, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 782: Advanced seminar in animal and environmental physiology II [3 units]
Current problems and recent advances in animal and environmental physiology with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 783: Advanced seminar in parasitology and public health I [3 units]
Current problems and recent advances in parasitology and public health outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of parasitology and public health, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 784: Advanced seminar in parasitology and public health II [3 units]
Current problems and recent advances in parasitology and public health with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his/her chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will

be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 785: Advanced seminar in entomology/forensic science I [3 units]
Current problems and recent advances in entomology/forensic science outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of entomology/forensic science, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 786: Advanced seminar in entomology/forensic science II [3 units]
Current problems and recent advances in entomology/forensic science with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his/her chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 787: Advanced seminar fisheries and aquaculture I [3 units]
Current problems and recent advances in fisheries and aquaculture outside the doctoral student research interest will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in specific area of fisheries and aquaculture, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 788: Advanced seminar fisheries and aquaculture II [3 units]
Current problems and recent advances in fisheries and aquaculture with regards to the doctoral student chosen area of research will be written up and presented by each doctoral student; this involves a critical review of current and relevant literatures in his/her chosen area of research, all doctoral students must effectively participate in all departmental postgraduate seminars. Score will be awarded on attendance and effective participation. All presentations must be ICT compliant and interactive.

ZEB 790: Thesis [12 Units]
Thesis must address field and/or laboratory study in the candidates area of specialization. A proposal, progress and final result seminars are mandatory. The research must be focused and contributes to solving of specific societal and/or environmental problems. Furthermore it must contribute significantly to the advancement of knowledge in the subject area. The output of such research should be publishable in top impact factor ranked journals.