Course No.	Course Title	Prerequisite	Syllabus	Hours	Hours/week	
& Code				L	T/P	С
Z 100	General Zoology	-	Protoplasm. Organization and function of animal cell. Study of the animal tissues. Life functions. Introduction to early development of animals. Characters and classification of the major animal phyla.	2	3	3
Z 210	Cytology	Z 100	The cell theory. Membranous organelles. Non-membranous organelles. The cell inclusions. The nucleus. Cell division. The phases of mitosis. Meiosis. DNA & RNA synthesis.	2	2	3
Z 212	Histology	Z 210	Detailed study of different types of animal tissues. Histological study of different types of animal systems. Macroscopical and microscopical views of a lesion. Cellular damage. Causes of cellular damage. Responses to cellular damage. Diseases of organ systems.	2	3	3
Z 213	Evolution	Z 100	Scope and historical development of evolutionary theory - Microevolution and macroevolution -Population dynamics and genetic -Natural selection, drift and other forces of evolution - Systemic and the species problem (species formation).	1	-	1
Z 217	Animal Physiology (1)	Z 100	Nutrition -Membranes and transport -Muscular system – Circulation -Respiration -Excretion - Osmoregulation and buffering system.	2	3	3
Z 219	Animal venoms and toxins	Z 100	Biology of venomous animals. Sources of animal venoms. Chemistry of venoms. Differences between venoms and toxins. LD50 of some venoms. How do animal venoms work? Antivenom. Biological importance of animal venoms.	1	2	2
Z 220	Invertebrates I	Z 100	Explanation of the classification of animal kingdom into the major Phyla. Characters of the major phyla: Protozoa, Porifera, Cnidaria, Platyhelminthes, Nematoda, Annelida and their classes.	2	2	3

## **Courses Offered by the Department of Zoology for the B.Sc. Degree**

Course No.	Course Title	Prerequisite	Syllabus	Hours	/week	
& Code				L	T/P	C
Z 222	Invertebrates II	Z 220	Classification of the major Phyla into Classes and the characters of each Class. Explanation of the characters of the major phyla: Arthropoda, Mollusca, and Echinodermata.	2	2	3
Z 225	Animal Ecology	Z 100	An introduction to ecology and its importance. Study of important physical ecological factors and their effects on living animals. Study of organisms and the interrelationships. Studies of biotic factors. Community and Ecosystem. Production in Ecosystems. Ecological Pyramids: Community Succession. Energy Flow Relationships. Food Chains. Food Webs. An introduction to environmental pollution; the effect of man and his activities on the environment.	2	2	3
Z 232	Vertebrates I	Z 100	Introduction to organization of chordates and the main groups of vertebrates. Emphasis also will be on the following: classification from class through species taxa, morphology, structure and function of organs, systems, developmental pathways, and fundamental concepts characteristic of this diverse group of animals from protochordates till Amphibia.	2	2	3
Z 240	General Entomology	Z 100	I- External Insect Morphology. II- Internal Anatomy. III- Molting and Metamorphosis. Introduction to insect classification.	2	2	3
Z 242	Insect Morphology	Z 240	External Morphology in different insect orders. Arthropodization - The Integument The head (Segmentation and evolution, primitive insect head, general pterygote head, appendages) – The thorax (General structure, appendages, mechanisms of flight). – The abdomen and external genitalia.	2	2	3
Z 270	Aquatic invertebrates	Z 100	The phylogeny, life-history, habitats and ecology of major aquatic invertebrates. The use of invertebrate taxa as biomonitoring criteria and impacts from exotic/invasive species. A field and laboratory study of aquatic invertebrate phyla including immature insects. Anatomy and functional morphology of invertebrate phyla; natural history of local forms.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 275	Aquatic Vertebrates	Z 100	The biology of aquatic vertebrate animals, including evolution, classification, and behavior of all major classes. Laboratories stress structural features, while field trips emphasize ecology, behavior, and identification of local forms.	2	2	3
Z 280	Fish Biology	Z 232	Definition of fields in Fish Biology. Fish external features, internal anatomy, endoskeleton and musculature. Methods of fish identification, concepts of systematic of fishes and the major groups of fishes (relationship and diversification). Fish habitats and aquatic ecosystems. Fish migrations. Food, feeding, nutrition and growth. Blood, circulation and respiration. Osmoregulation, reproduction, integration and behavior. Ecology and zoogeography. Fishes as resources. Egyptian fishes.	2	2	3
Z 282	Cell biology and fish embryology	Z 280	Modern studies of cell structure and function at the cellular, subcellular, and molecular levels. Topics include molecular components of cell membranes, membrane-bound organelles, microtubular and cytoskeletal components, and principles of bioenergetics. Descriptive and experimental study of the development of fishes with emphasis on Clarias and tilapias development. Gameotogenesis, fertilization, cleavage, gastrulation, organogenesis, and mechanisms involved in control of shaping, pattern and gene expression during development.	2	2	3
Z 284	Fish physiology	Z 280	Introduction to Fish physiology. Mechanisms of gas transfer, circulation, excretion, osmoregulation, locomotion, and neural/hormonal control of these systems in fishes. Comparisons and contrasts with physiology of terrestrial animals. Survey of physiological adaptations of fish to environmental factors; bioenergetics, homeostasis, senses adaptations to diverse and extreme aquatic environments.Practical applications of fish physiology to aquaculture, pollution assessment, and fisheries management.	2	2	3

Course No.	Course Title	Prerequisite	Syllabus	Но	ours/we	ek
& Code				L	T/P	С
Z 285	Fish ecology	Z 280	Basic principles of fish ecology at the individual, population, and community level. Interrelationship between fishes and biotic and abiotic environments; fundamental links in the life cycles of fishes : development, growth, feeding, reproduction and migration; habits and behaviors. The application of fish ecological principles and modeling to the conservation and management of fisheries resources and aquatic habitats and the aquatic environment	2	_	2
Z 290	Aquatic ecosystems	Z275	An introduction to the structure, types and components of aquatic ecosystems, how they are regulated by physical, chemical and biological factors, and the impact of humans on these environments and their biota. The life cycles and adaptations of aquatic organisms. Management of aquatic ecosystems for ecological and socioeconomic objectives. Special attention to the Egyptian aquatic ecosystems drawing a parallel between freshwater and marine ones in respect of fisheries.	2	_	2
Z 291	Criteria of water quality	Z 290	Fundamentals of water chemistry and physical characteristics. Worldwide standards of water characteristic suitable for fish and aquaculture in different environments. Chemistry and quality management of surface water, pond water and aquarium water on the light of different pollutants. The current status of water quality in Egyptian aquatic ecosystems.	2	2	3
Z 292	Biology of water pollution	Z 291	Aquatic systems; mechanisms of interaction; physical alterations; nutrients and eutrophication, acidification; pesticides; heavy metals; petrochemicals; industrial wastes; thermal pollution, radioactivity,, oils, field analysis; land use and planning concepts; biological organization of lakes, rivers, estuaries, and the deep sea; human impact on aquatic environments; laboratory and field approaches to the study of natural processes. Biological assessment of water quality. Management of water resources on the light of water pollution.	2	2	3

Course	Course Title	Prerequisite	Syllabus	H	ours/we	eek
No. & Code				L	T/P	C
Z 293	Limnology	Z 290	Nutrient cycles, energy transfer, ecological factors, distribution of organisms and human affection to ecosystem, including the conservation of freshwater ecosystem. Physical, chemical and biological aspects of lakes and other inland waters. Eutrophication.	2	2	3
Z 294	Marine biology	Z 290	Introduction to basic processes of primary and secondary production in the sea, the structure and dynamics of marine communities. Comprehensive study of the ecology and general biology of the marine biota. Stresses, life histories and trophic relationships, adaptations for marine life, and limitations imposed by marine environments. Overview of structure, physiology, and ecology of marine life from phytoplankton to whales. Labs cover the representative marine divisions (plants) and phyla (animals) and may include a field trip to the Red Sea and Mediterranean Sea.	2	2	3
Z 295	Fish Farming	Z 280	Introduction to aquaculture. Preliminary notes on evolution of fish culture and requisite conditions for fish suitable for fish culture. Construction, layout, maintenance and improvement of ponds. Natural food and growth of cultivated fish. Techniques and methods of fish breeding and cultivation. Management of fish farm. Enemies and diseases of fish. Cultivation of tilapias or African catfish as example. Aquaculture in Egypt.	1	2	2
Z 296	Fisheries climatology	Z 290	Effects of natural environmental variability on the recruitment, availability (yield), abundance and behavior of living marine resources. Application to real-time fishing operations and climate scale analysis of fishery fluctuations. Instruction in basic meteorology and climatology with application to the ocean and freshwater ecosystems.	2	2	3
Z 297	Fish Zoogeography	Z 290	Introduction to zoogeography. Patterns and processes of distribution of aquatic biota on the earth, across a wide range of spatial and time scales The diversity of the world's 25,000+ species of fishes. A primarily phylogenetic organization during tracing the evolution of fishes over their history. Patterns of marine and freshwater geographic distribution. Modern methods and concepts associated with studies of biodiversity.	2	2	3

Course	Course Title	Prerequisite	Syllabus	H	ours/w	eek
No. & Code				L	T/P	C
Z 310	Animal Physiology (2)	Z 217	Endocrinology (hormones biochemistry, hormone receptors, hormone action mechanism, control of hormone secretion, dysfunction of endocrine gland). Nervous system (Central and peripheral nervous system, sympathetic and parasympathetic system, neurotransmitters). Sensory system (sensory receptors and transduction, sense organs).	2	2	3
Z 311	Molecular Biology	Z 210	DNA structure - Genome organization in prokaryotic and eukaryotic cell - DNA replication and repair - Translation - Gene expression in eukaryotes Recombinant DNA techniques - Postranslational protein modification.	1	3	2
Z 312	Cell Biology	Z 210	Cell growth and proliferation. The cell cycle Apoptosis and its mechanism. Cellular aging and related terms.	2	2	3
Z 313	Animal Behavior	Z 100	Schools of the study animal behavior -Characteristic and components of innate behavior -Animal learning -Animal communication -Protective behavior - Social behavior.	1	-	1
Z 314	Genetic engineering	Z 311	Biotechnology and recombinant DNA- Restriction enzymes and basic cloning- DNA sequencing and PCR- Animal genetic engineering -Human genome project- regulations and ethics- Genetic testing for diseases- DNA technology in criminal cases - Gene therapy to treat diseases –Cloning-New drugs based on genetic your profile - Genetically engineered food - Genetic engineering in the future	1	3	2
Z 316	Histochemistry	Z 212	Study of chemical components of carbohydrates, proteins, lipids, nucleic acids, etc. in the cells and tissues including methods for their detection. Detecting methods of some enzymes in animal tissues.	1	2	2
Z 317	Microtechnique	Z 212	Methods and tools used in the study of the cell and tissues of animals. Different types of microscopes. Principles of electron microscopes. Resolution of electron microscopes. Specimen preparation for transmission electron microscope. Specimen preparation for scanning electron microscope. Application of electron microscopes.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours/week		
Code				L	T/P	С
Z 318	Cell and molecular biology	Z 210	The cell theory. Membranous organelles. Non-membranous organelles. The cell inclusions. The nucleus. Cell division. DNA & RNA synthesis and structure. DNA structure- Genome organization in prokaryotic and eukaryotic cell- DNA replication and repair - Translation - Gene expression in eukaryotes Recombinant DNA techniques.	2	2	3
Z 319	Aquatic toxicology	Z 290	Principles and methods of aquatic toxicological study and hazard evaluation; types of toxic chemicals and other pollutants found in aquatic systems and their harmful effects on aquatic organisms and ecosystem. Toxicological effects of aquatic pollution focusing on fate and transport of xenobiotics; accumulation, dynamics and toxicity of xenobiotics in aquatic organisms; analysis and modeling of the effects of aquatic pollution on organisms and aquatic communities; and the determination of related risks to aquatic ecosystems.	2	2	3
Z 321	Parasitology	Z 220	Principles of parasitology. Introduction to parasitism history and evolution of parasitism, types of parasitism; hostparasite relationships. Parasitic Protozoa, trematodes, cestodes, nematodes and ectoparasites.	2	3	3
Z 323	Aquatic ecology	Z 225	Basic knowledge of the structure and the functioning of freshwater ecosystems. The abiotic (physical and chemical) characteristics of lakes and rivers, as well as the qualitative and quantitative composition of the different biological communities as reviewed components. Describing and illustrating the fundamental concepts and general processes governing marine ecosystems. Types of shores and the main components of animals with case study to the Red-Sea.	1	2	2

Course No. &	Course Title	Prerequisite	Syllabus	Hours/week		
Code				L	T/P	С
Z 324	Protozoology and Parasitology	Z 100	Characters and classification of free-living and parasitic Protozoa. Principles of parasitology. Introduction to parasitism history and evolution of parasitism, types of parasitism; hostparasite relationships. Parasitic Protozoa, trematodes, cestodes, nematodes and ectoparasites.	2	2	3
Z 327	Malacology	Z 270	The morphology, taxonomy, biology, ecology, physiology and the technology of artificial reproducing larvae and culture of common economic mollusk. Breeding and culturing the adult in coastal areas or inland waters.	2	2	3
Z 328	Population Dynamics	Z 225	Historical development. The raw material of population dynamics. Animal communities and ecosystems. Evaluation, causes, and impacts of the rates of change in survival, growth, reproduction, and recruitment for Animal populations. Drawings and examples for the above mentioned.	2	2	3
Z 330	Vertebrates II	Z 232	Classification, morphology, structure and function of organs, systems, developmental pathways, and fundamental concepts characteristic of amniotes (reptiles, birds and mammals).	2	2	3
Z 333	Ornithology	Z 330	Structure, classification, distribution, life histories, economic importance, techniques of field study, method of collection, and preservation of different taxonomic groups of birds on a world-wide basis, with detailed examination of Egyptian species. Exploration of the biological and ecological life requirements of important groups of Egyptian birds.	2	2	3
Z 334	Principles of Embryology	Z 232	Introduction – Gametogenesis – Fertilization – Cleavage – Blastulation – Gastrulation - Axis formation- Early embryonic development of Amphioxus, Amphibians, Chick and Mammals.	2	3	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours/week		
Code				L	T/P	С
Z 336	Mammalogy	Z 330	Structure, classification, distribution, life histories, economic importance, techniques of field study, method of collection, and preservation of different taxonomic groups of mammals on a world- wide basis, with detailed examination of Egyptian species.	2	2	3
Z 340	Insect Taxonomy	Z 240	History of insect taxonomy Importance of insect taxonomy Modern taxonomy (origin and evolution). axonomic categories The international rules of insect nomenclature Vernacular name Description of specimen - Classification and phylogeny of insects Types of references How to present taxonomic data in a scientific paper.	2	2	3
Z 341	Insect Comparative Anatomy	Z 242	Studying the following systems in different insect orders: digestive system- Respiratory system- Circulatory system- Excretory system- Muscular System- Nervous system and sensory structures- and Reproductive system.	2	2	3
Z 342	Economic Entomology	Z240	Introduction of economic entomology. Beneficial and harmful insects. Types of insect pests. Pests of cultivated crops, vegetables and fruits. Pests of household material (carpet, cloth, wood, paper, etc.).	2	2	3
Z 343	Insect Physiology (I)	Z 240	Hormonal control of the integument– Physiology of metamorphosis and growth– Digestion– Respiration– Excretion– Circulatory system- Reproduction.	2	2	3
Z 344	Medical Entomology and Insect Diseases	Z 340	Diseases and harms caused by insects. Insects as vectors for protozoa and parasitic worms (Their mode of infection and Life cycles) – Protection and control. Mechanical, physical, and chemical injuries. Microbial and non-microbial diseasesGenetic diseases. Epidemic of insect diseases.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours/week		
Code				L	T/P	С
Z 346	Insect-Plant Interactions	Z 340	Insects as pollinators, seed dispersers, sources of plant food, defense providers- Roles of insects in recycling of dead animals, dung, and dead plants. Insects as pests for plants and reaction of plants to insect herbivory. Chemical and physical signals that shape the relation between insects and plants. Phytochemicals and secondary metabolites produced by plants due to insect attacks. Plant-derived insecticides.	2	2	3
Z 351	Parasitic Insects	Z 220	Definition and types of parasitism. Insects as parasites of both vertebrate and invertebrate animals. Insects as hosts for other parasites. Order Hymenoptera as the major group of parasites on insect hosts. Egg, larval, and Pupal parasitoids and their hosts Parasitoids of adult insects. Parasites of social insects: trophic parasitism; slave making, etc.	2	2	3
Z 352	Experiment Designing & Insect Rearing	Z 340	Basic epistemological concepts. Inductive and deductive methods of science. Teleology and phenomenology in science. Proximate and ultimate causation. Difference between descriptive and experimental scientific work. Hypothesis and theory. What is a scientific experiment? Precautions of experiment: controlling variables, elimination of error sources, avoiding misleading or insufficient techniques. Choosing appropriate statistical tests. Basic features of statistical tests. Differences between Type I and Type II errors. Single comparisons and multiple comparisons. Limits of extrapolation depending on type of empirical data. Phrasing the conclusions of experimental results.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 353	Insect Embryology	Z 240	The egg structure: Cytoplasm, vitelline envelop, and chorion. Egg respiration– Water regulation. Embryology: Cleavage and blastoderm formation. Vitellophages– Germ band formation– Determination of the body axes and segmentation. Gastrulation– Formation of embryonic membranes– Movements of the embryo- Dorsal closure– Ectodermal structures. Mesoderm and body cavity. Alimentary canal. Reproductive system. Viviparity, Polyembryony, Parthenogenesis, Pedogenesis. Postembryonic Development: Hatching– Larval development– Metamorphosis– Control of postembryonic development. Polyphenism– Diapause.	2	2	3
Z 354	Aquatic Insects	Z 340	Introduction. Origin of aquatic insects, Aquatic Insect Orders, Key to aquatic insect orders, Habitats and communities (Permanent habitats, temporary habitats, Man-made habitats), life history and habitats.	1	2	2
Z 371	Fish population dynamics	Z285	Historical development. The raw material of population dynamics. Fish community and aquatic ecosystems. Theories and models of the exploited fish populations' dynamics. Quantitative analysis of fish populations. Evaluation, causes, and impacts of the rates of change in survival, growth, reproduction, and recruitment for fish populations and their yield. Tagging. Examples.	2	2	3
Z 372	Fish stock assessment and fisheries management	Z371	Introduction including primary objectives of fish stock assessment, the stock concept, models. Estimation of growth parameters, the von bertalanffy growth equation, methods for estimation of growth parameters. Estimation of mortality rates, the concept of a cohort and some basic notation, the dynamics of a cohort, the exponential decay model. Natural and fishing mortality estimation. Virtual population methods. Gear selectivity. Prediction models. Multispecies/multifleet problems. Assessment of migratory stocks. The stock/recruitment relationship. Demersal trawl surveys. Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. Application of quantitative methodologies for the assessment and manipulation of aquatic habitats, sport and commercial fish populations, and human resource users and non-users are considered, as is the setting of appropriate goals and objectives for effective, science-based management. Fisheries management as a science with an emphasis on freshwater fishes and ecosystems.	2	2	3

Course	Course Title	Prerequisite	Syllabus	Hours	/week	
No. & Code				L	T/P	C
Z 373	Commercial and recreational fisheries	Z 285	Introduction to types of fisheries of commercial and recreational importance. Identification of the work of fishery scientists. Population analysis of unexploited and exploited populations. Fisheries management techniques and principles and their interactions with fishermen and biotic and abiotic environments. Recreational and commercial fisheries managements. Fishery development in Egypt. Fishery law and regulations in general. Law of fisheries rights in Egyptian waters.	2	-	2
Z 374	Fisheries products and marketing	Z373	Introduction to fisheries product and marketing. Fish processing technology. Micro- organisms affecting to fish processing and fishery products. Product development and quality requirement. Principles and procedure in analysing the composition of fishery products by chemical and physical menthods. The chemical and sensory evaluation of fishery products. Principles of quality control. Methods for determining quality of raw material and fishery products. Principles of fish marketing. Fish marketing and fisheries economics and regulation. Planning to extend market. Export markets. The influence of tradition and change, International cooperation.	2	2	3
Z 376	Fisheries environmental awareness	Z 373	Awareness of the impact that people, industry, and development have on the environment related to the fisheries' industry. Awareness of proper use and disposal of materials hazardous to the environment and how other industries can affect the fisheries industry and environment.	2	2	3
Z 377	Techniques and methods in fish biology	Z 280	Introduction. Methods in genetics, systematics, and taxonomy. Electrophoresis, chromosome preparation and analysis, histological techniques, anesthesia, surgery and related techniques, blood and hematological methods, respirometry and growth techniques and methods, bioenergetics, reproductive, autoecology, coomunity-ecology and nervous system methods.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code		_		L	T/P	С
Z 378	Fishing methods and tools	Z 373	Introduction to catching methods in fisheries. Fishing by gathering. Male and female divers. Animals as a help in fisheries. Line fishing: basic implements, gear and methods. Fishing for sport and recreation. Attracting, concentration and frightening fish. Pole-hooks and rippers. Natural and artificial shelters. Mechanical fishing gears: traps, lines and snares. Permanent and temporary barriers. Trapping. Fishing in the air. The art of net making. Fishing with bottom trawls. Seining in fresh and sea water. The drive-in fishery. Lifnets and fish wheels. Cover pots and cast nets. Gillnetting. Entangling nets. Fishing system and harvesting machines. Classification of catching nets. Others.	2	2	3
Z 379	Types and design of fish farms	Z 280	Introduction to fish farm design and engineering. Principles and criteria for site selection for fish ponds. Surveying, mapping and construction of fish ponds and water system in different environments. Design of ponds on the light of culturing facilities. Design of fish farms in different localities in Egypt.	2	2	3
Z 384	Techniques in fishery biology	Z 373	Overview of fishery research methods: sampling theory, collection gear, stock identification methods, age and growth, tagging, and estimation of population size. Planning for sampling; sample fish populations using active and passive gears in lentic and lotic habitats; measure aquatic habitats; mark and tag fish; conduct angler surveys; age fish using hard part analysis; and apply remote sensing to fisheries study.	2	2	3
Z 391	Biology and aquaculture of tilapias	Z 280	Introduction to cichlids, their distribution, economics and taxonomy. Cichlids suitable for cultivation. Reproduction of tilapias. Feeding and growth of tilapias. Methods of rearing tilapias. Tilapias rearing system in Africa. Future prospectis of the cultivation of tilapias. Pond and hatchery design for tilapias. Aquaculture of tilapias in Egypt.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 392	Biology and aquaculture of African catfish	Z 280	Introduction to catfishes, their distribution, economics and taxonomy. African catfishes suitable for cultivation. Reproduction of African catfishes. Feeding and growth of catfishes. Methods of rearing African catfishes. Catfishes rearing system in Africa. Future prospectis of the cultivation of African catfishes. Pond and hatchery design for catfishes. Aquaculture of African catfish in Egypt	2	2	3
Z 394	Wastewater aquaculture	Z 280	Use wastewater to enhance productivity of aquaculture systems. Functional similarity between wastewater treatment lagoons, fertilized fish ponds, and wastewater aquaculture systems. Polyculture in wastewater aquaculture; case studies	2	2	3
Z 400	Research Project / Article	100 credit hours	A short research or an essay project must be prepared as a year- extended course.	2	-	2
Z 401	Special topics in Zoology I	Department consent	To be determined by the department	2	-	2
Z402	Special topics in Zoology II	Department consent	To be determined by the department	2	-	2
Z 411	Physiology of Reproduction	Z 310	History of reproduction-Male reproductive system-Composition of seminal fluid -Female reproductive system-The estrous cycle and hormonal regulation -Mating behavior-Causes of reproductive failure - Comparative reproductive physiology (Fishes- Amphibia-reptiles- birds and mammals)	2	-	2
Z 412	Immunology	Z 310	-Functional organization of the immune system -Organs and cells of the immune system -Molecules in immune reaction -The immune response - Regulation of the immune processes -The Immunological methods.	2	-	2
Z 413	Hematology	Z 310	-Body fluids analysis-Composition and formation of bloodBlood grouping-Hemostasis and tests related to the detection of bleeding and thrombotic problems. -Anemias and leukemia -Routine procedure used in the hematology laboratory.	1	2	2

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 414	Ecophysiology	Z 310	Basic understanding of physiological response to natural and man made environmental conditions. Physiological effect of abnormal and atmospheric pressure. Physiological response to heat stress and low temperature exposure. Physiology of tissue adaptation to injury. Disorder of the stress response	2	-	2
Z 418	Introduction to embryology and evolution	Z 100	Introduction – Gametogenesis – Fertilization – Cleavage – Gastrulation- Early embryonic development of Amphioxus, Amphibians, Chick and Mammals. Scope and historical development of evolutionary theory -Microevolution and macroevolution -Population dynamics and genetic -Natural selection, drift and other forces of evolution -Systemic and the species problem (species formation).	2	2	3
Z 422	Biodiversity	Z 225	Definition of biodiversity with special reference to animals. Studies of minor Phyla and their characteristics. Studies of conservation of species.	2	2	3
Z 423	Aquatic Crustacea	Z 270	Taxonomy, biology, life history, reproduction of aquatic crustacea of economic importance. Artificial spawning and breeding. Farming and farm construction of crawfishes and shrimps.	2	2	3
Z 424	Aquatic biodiversity	Z 270	Introduction to biodiversity and conservation biology. Interdisciplinary analysis of biodiversity conservation and related science policy issues. How biodiversity is measured and what are the major patterns of diversity. Definition of structural and functional biodiversity and the relationship between the two. Fish biodiversity in relation to fisheries conservation, live fish transportation policies, exotic fish introductions and genetics of natural fish populations. Topics include: background to biodiversity; invasive alien fish species; balance between benefits and negative impact of aliens; population explosions of invasive species; modeling of the impact of biological invasions; introduction at the level of populations and genes; infectious diseases from alien species; invading species in estuaries and freshwater ecosystems.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 427	Plankton and benthos	Z 270	Classification morphololgy, and physiology of marine and freshwater planktons. Qualitative and quantitative studies including brief accounts of primary productivity. Ecology of plankton; positive and negative effects of plankton production on other aquatic organisms and fisheries; methods of plankton culture. Taxonomy and ecology of benthic animals, Their significance to fisheries and aquatic environment	2	2	3
Z 432	Vertebrate Comparative Anatomy	Z 330	An integrated comparative study of vertebrate structure and development with emphasis on relationships between form, function, and evolution and the similarities of anatomy and phylogenetic relationships of major vertebrate groups. This comparative study includes different vertebrate body systems.	2	4	3
Z 433	Vertebrate Taxonomy	(للمصايد)Z275 Z 330 (للحيوان)	Principles of systematic: evolutionary, phenetic, and cladistic techniques. Classification of vertebrates, identification of vertebrate species using keys and field observation. Collecting, preserving, and storage of vertebrate specimens.	2	2	3
Z 437	Developmental Biology	Z 334	Cellular and molecular mechanisms that regulate animal development. Induction and cell communication. Development of different body systems. Limb development. Axis formation. Morphogens and stem cells. Development and oncogenes.	2	3	3
Z 438	Experimental Embryology	Z 437	Introduction - Basic requirements- Experimental models – Experiments on induction- Transplantation. Regeneration.	1	3	2
Z 441	Insect Physiology (II)	Z 343	Nervous and endocrine system - Insect sense organs - Pheromones - Muscular system.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 442	Principles of Insect control	Z 340	<ul> <li>A- History and principles of insect control, Pests and pest harmful.</li> <li>Types of pest control.</li> <li>B- Chemical control: Pesticides Discovery, Classification of insecticides, Problems generated due to overuse of pesticides, Resistance against pesticides.</li> <li>C- Other methods of pest control: Synergestics and pesticide combinations, Insect growth regulators, Insect development inhibitors, Ovicides, Antifeedants, Autocidal control, Behaviorbased insect control, Integrated Pest Management (IPM).</li> </ul>	2	2	3
Z 443	Insect Ecology	Z 240	A- An overview of insect ecology: introduction to insect ecology, fossil history and insect evolution, habits of insects, the number of insect species richness, variations in species number, abundance, insects and humans. B- Insects and Climate: Temperature, photoperiod, rainfall, wind, climate change. C- Insect Herbivores: Trouble with plant as food, feeding strategies of herbivorous insects, plant defenses, overcompensation. D- Insects in Ecosystems: fundamentals of ecosystem, Insects and the terrestrial carbon cycle, leaf-shredding insects and stream ecosystems.	2	2	3
Z 444	Insect Behavior	Z 441	Origins of the science of insect behavior - Releasers and supernormal releasers Insect learning Orientation and navigation Insect communication The honeybee language Protective behavior in insects Mimicry and its varieties Insect rhythms The social life of insects. Kin selection and the evolution of insect sociality.	2	-	2
Z 446	Specialized Field Training	Z 340	Factors affecting insects in their natural habitat Requirements of field work Observation of insect life and behavior Types of insect traps Collecting insects from different habitats. Preservation of insect specimens Designing field experiments monitoring of existing insect population; introducing an insect into the field for experiment; gathering and analysis of field data.	1	4	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 447	Insect Immunity	Z 343	A- Cellular Immunity: Insect hemocytes involved in cellular defense reactions – Phagocytosis – Cellular encapsulation – Humoral encapsulation – Nodule formation – Phenoloxidases and their possible role in cellular and humoral encapsulation – Resistance to cellular defense reactions. B- Humoral Immunity: Factors normally present in insect hemolymph – Factors inducible upon infection – Resistance to humoral immune reactions.	2	-	2
Z 451	Acarology	Z 222	Historical introduction – Collection – Preparation for Study – External Morphology – Biology and life cycle – Classification – Distribution, abundance, and environmental variable – Agricultural importance - Medical and veterinary importance of house-dust mites and ticks – Treatment and control.	2	2	3
Z 452	Special Topics in Entomology I	Department consent	To be determined by the department	2	-	2
Z 453	Pests of Stored Grains	Z 340	The loss in stored grains and legumes and its causes Factors inducing spread of stored product insects Damage caused by the infestation with stored product insects Grouping of stored product insects according to feeding habits and systematic position Orders Lepidoptera (moths) and Coleoptera (weevils and beetles), example stages that cause the damage, and methods for control Hygienic methods for storage of grains and legumes Methods for the assessment of the levels of infestation with stored product insects Precautions required for reduction/prevention the infestation with stored product insects Control measures of the stored product insect pests.	2	2	3
Z 454	Essentials of Insecticide Action	Z 441	Toxicity and hazards of pesticides - Mode of insecticides action - Insecticides with novel mode of action - Principles of pesticides' metabolism. Insect resistance to insecticides.	2	3	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 456	Insect Sociobiology	Z 443	Evolutionary roots of insect sociality. Types of insect societies. Structure of social insect colonies. Caste formation and differentiation. Division of labor in insect colonies. Habits and habitats of insect colonies. Social insects belonging to orders other than Hymenoptera and Isoptera.	2	-	2
Z 457	Special Topics in Entomology II	Department consent	To be determined by the department	2	-	2
Z 458	Insect sensory ecology	Z 343	Tactile receptors and their importance. Chemoreceptors (taste and olfaction sensilla) and their role in insect communication. Photoreceptors (ocelli and apposition and superposition eyes). Sound production and sound receptor apparatuses. Primary processing of sensory information. The role of different sensory modalities in the shaping of insect behavior.	2	-	2
Z 459	Biological control	B 442	The scope of biological control, Role of biological control in IPM: A- The natural enemies: Predators, Parasites. – Utilization: Importation. Augmentation – Some outstanding case histories B- Fungal control C- Viral control.	2	2	3
Z 471	Fisheries economics	Z372	Importance of fishery resources to the economy. Role of fishery as part of the whole economics production in a country. An introduction to economic theories and principles which determine the exploitation, utilization, and management of freshwater and marine fisheries. Analysis of fisheries economics and bioeconomic models. Economics aspects of fishery performance of management regulations.	2	-	2
Z 472	Fish nutrition and production	Z 280	Theory and practice of fish nutrition for optimal fish production. The concept of feeding fish. The nutrients, digestion and metabolism, nutrient diet components, feed formulation and processing, fish feeding experiments, practical feeding for catfish, tilapias, shrimps and crawfish. Nutritional pathological diseases. Breeds of fishes in the Arab countries. Principles of breeding, selection and genetic improvement. Factors affecting animal production.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 473	Fisheries field projects	Z 372	Designed to enable a student to work in a field of their choice with employees in industry. Student will gain valuable experience while showing perspective employers their skills and work habits.	2	2	3
Z 474	Fish parasites and diseases	Z 280	Introduction to basic concepts of parasitology and fish diseases. Morphology, taxonomy, life history, ecology and pathological effects of parasites on fishes including their control. Management principles to prevent and control diseases and parasites. Control of wild fish, stocking density, water quality, age segregation and elimination of parasites from fishes; fish quarantine. Nutritional pathological diseases are considered for comparison. Survey of Fish diseases and parasites in Egyptian fishes.	2	2	3
Z 481	Principles of reproduction and fish breeding	Z 280	Strategies of reproduction in aquatic organisms especially fishes. Reproductive development, sexual maturation, spawning and incubation in selected fish and invertebrate species; embryology and developmental traits of some species; practical experience in artificial spawning techniques, egg handling and care, incubation techniques and the handling of newly-hatched larvae. Artificial spawning and water characteristics. Reproduction and endocrines. Reproduction and biotechnology and genetic engineering.	2	2	3
Z 482	Fish hatchery management	Z 481	Study of selection and care of brood stock, hatching eggs, care and feeding of young, natural and artificial propagation, grading, stocking, and hatchery equipments. Economic importance of hatchery. Hatchery and biodiversity.	2	-	2
Z 483	Hatchery field projects	Z 482	Students will work at a hatchery with the species of fish of their choice. Gaining valuable experience while showing prospective employers their skills and work habits. Experience will be gained by working at a hatchery with various species of fish. This allows student to show prospective employers the skills and work habits they have and gain valuable experience.	2	2	3

Course No. &	Course Title	Prerequisite	Syllabus	Hours	/week	
Code				L	T/P	С
Z 492	Fish Aquaculture	Z 280	Introduction to aquaculture. Preliminary notes on evolution of fish culture and requisite conditions for fish suitable for fish culture. Construction, layout, maintenance and improvement of ponds. Natural food and growth of cultivated fish. Techniques and methods of fish breeding and cultivation. Management of fish farm. Enemies and diseases of fish. Cultivation of tilapias or African catfish as example. Aquaculture in Egypt.	2	2	3
Z 494	Fisheries Science	Z 280	Introduction to types of fisheries and work of fishery scientists. Population analysis of unexploited and exploited populations. Fisheries management techniques and principles. Recreational and commercial fisheries managements. Fishery development in Egypt.	1	2	2
Z 496	Fish Stock Assessment	Z 280	Introduction including the primary objective of fish stock assessment, the stock concept, models. Estimation of growth parameters. Estimation of mortality rates, the concept of a cohort and some basic notation, the dynamics of a cohort, the exponential decay model, and other models. Fishing and natural mortality estimation. Virtual population methods. Gear selectivity. Prediction models.	1	2	2