



**King Saud University**  
**Collage of Science**  
**Vice Dean Academic Affairs**  
**Study Plans**



# **Zoology Study Plan**



## **Zoology Department**

**2013-1434H**



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# Zoology Study Plan

1 <sup>st</sup> Semester				
Course Code	Course Title	Pre-Req.	Co-Req.	Credits (Lect.- Exer.-Pract.)
CI 140	Learning, Thinking and Research Skills	-	-	3 (3+0+0)
CHS 150	Health and Fitness (2)	-	-	1 (1+0+0)
ENG 140	English Language (1) (E)	-	-	8 (8+0+0)
MATH 140	Introduction to Mathematics (E)	-	-	2 (1+1+0)
Total of Credit Hours				14

2 <sup>nd</sup> Semester				
Course Code	Course Title	Pre-Req.	Co-Req.	Credits (Lect.- Exer.-Pract.)
CT 140	Computer Skills (E)	-	-	3 (0+0+3)
MC 140	Communication Skills	-	-	2 (2+0+0)
ENG 150	English Language (2) (E)	ENG 140	-	8 (8+0+0)
MATH 150	Differential Calculus (E)	140 MATH	-	3 (2+1+0)
ENT 101	Entrepreneurship	-	-	1 (1+0+0)
Total of Credit Hours				17

3 <sup>rd</sup> Semester				
Course code	Course Title	Pre-req.	Co-Req.	Credits (Lect. Exer. -Pract.)
Elective course from University requirement		-	-	2 (2+0+0)
Elective course from University requirement		-	-	2 (2+0+0)
CHEM 103	General chemistry (1)*	-	-	3 (3+0+0)
GEO 105	Geology*	-	-	2 (2+0+0)
STAT 106	Biostatistics*	-	-	2 (1+1+0)
BOT 102	General Botany*	-	-	3 (2+0+1)
ZOOL 103	Principles of General Zoology*	-	-	3 (2+0+1)
Total of Credit Hours				17

4 <sup>th</sup> Semester				
Course code	Course Title	Pre-req.	Co-Req.	Credits (Lect. Exer. –Pract.)
Elective course from University requirement			-	2 (2+0+0)
BCH 101	General biochemistry*	-	-	4 (3+0+1)
PHYS 205	Biophysics*	-	-	2 (2+0+0)
MBIO 140	Microbiology*	-	-	3 (2+0+1)
ZOOL 212	Parasitology	ZOOL 103	-	3 (2+0+1)
ZOOL 242	Cell biology & Physiology*		-	3 (2+0+1)
Total of Credit Hours				17

5 <sup>th</sup> Semester				
Course code	Course Title	Pre-req.	Co-Req.	Credits (Lect. Exer. –Pract.)
ZOOL 245	Histology	ZOOL 242	-	2 ( 1+0+1 )
ZOOL 262	Microtechniques	ZOOL 103	-	2 ( 1+0+1 )
ZOOL 305	Animal modern Taxonomy		-	2 ( 1+0+1 )
ZOOL 320	Ichthyology		-	2 ( 1+0+1 )
ZOOL 327	Herpetology		-	3 ( 2+0+1 )
ZOOL 332	General physiology*		-	3 ( 2+0+1 )
ZOOL 373	Terrestrial ecology		-	2 ( 1+0+1 )
Total of Credit Hours				16

6 <sup>th</sup> Semester				
Course code	Course Title	Pre-req.	Co-Req.	Credits (Lect. Exer. -Pract.)
Elective course from University requirement		-	-	2 ( 2+0+0 )
ZOOL 311	General Entomology	ZOO 103	-	3 ( 2+0+1 )
ZOOL 325	Ornithology		-	2 ( 1+0+1 )
ZOOL 326	Mammology		-	2 ( 1+0+1 )
ZOOL 342	Molecular biology*	ZOOL 242	-	2 ( 1+0+1 )
ZOOL 374	Aquatic ecology	ZOOL 103	-	2 ( 1+0+1 )
Elective courses		Variable	-	4
Total of Credit Hours				17

Summer Semester				
Course Code	Course Title	Pre- Requisite	Co- Requisite	Credits (Lect. Exre. -Pract.)
ZOOL 465	Field studies	Finishing 34 Specialized Units	-	5(0+0+5)
Total of Credit Hours				5

7 <sup>th</sup> Semester				
Course Code	Course Title	Pre-Req.	Co-Req.	Credits (Lect. Exer. -Pract.)
ZOOL 317	Medical arthropods*	ZOOL 311	-	3 ( 2+0+1 )
ZOOL 352	Principles of genetics*	ZOOL 342	-	2 ( 1+0+1 )
ZOOL 375	Pollution	ZOO 103	-	2 ( 1+0+1 )
ZOOL 420	Comparative vertebrate anatomy*		-	2 ( 1+0+1 )
ZOOL 423	Principles of descriptive embryology		-	2 ( 1+0+1 )
ZOOL 432	Endocrinology*		-	2 ( 1+0+1 )
ZOOL 497	Training Course	ZOOL 342	-	2 ( 0+0+2 )
Elective course		Variable	-	2
Total of Credit Hours				17

8 <sup>th</sup> Semester				
Course Code	Course Title	Pre-Req.	Co-Req.	Credits (Lect. Exer. -Pract.)
ZOOL 424	Principles of experimental embryology*	ZOOL 423	-	2 (1+0+1)
ZOOL 425	Economic fishes and crustaceans	ZOOL 320	-	2 (1+0+1)
ZOOL 433	Immunology*	ZOOL 332	-	2 (1+0+1)
ZOOL 461	Laboratory technology*	ZOOL 262	-	2 (0+0+2)
ZOOL 471	Animal behavior	ZOOL 103	-	2 (1+0+1)
ZOOL 498	Graduation project*	Finishing at least 95 credit hours		2 (2+0+0)
Elective Courses		Variable	-	4
Total of Credit Hours				16

(Lect. – Exer. – Pract.) = (Lecture – Exercise – Practical) \* Courses given in English.



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**List of the Elective Courses of the University Requirements**

**(Student selects 8 credit hours)**

Course Code	Course Title	Pre-requisite	Credits (Lect. – Exer. - Pract.)
IC 100	Studies in the Biography of the Prophet	-	2 (2+0+0)
IC 101	Introduction of Islamic Culture	-	2 (2+0+0)
IC 102	Islam and Building up the Society	-	2 (2+0+0)
IC 103	Economic System in Islam	-	2 (2+0+0)
IC 104	Political system in Islam	-	3 (2+0+1)
IC 105	Human Rights	-	3 (2+0+1)
IC 106	Islamic Jurisprudence	-	2 (2+0+0)
IC 107	Ethics of Occupation	-	2 (2+0+0)
IC 108	Contemporary Issues	-	2 (2+0+0)
IC 109	Woman and Her Developmental Role	-	2 (2+0+0)

**List of Elective courses**

**[Student selects 10 Credit hours from list (A) OR (B)]**

(A) Elective courses from Zoology			
Course Code	Course Title	Pre-req.	Credits (Lect. Exre. – Pract.)
ZOOL 355	Animal Wildlife Genetics	ZOOL 352	2 (2+0+0)
ZOOL 366	Management of fish culture	ZOOL 320	2 (1+0+1)
ZOOL 381	Economics of Aquaculture	ZOOL 320	2 (1+0+1)
ZOOL 382	Entomofauna of Saudi Arabia	ZOOL 311	2 (1+0+1)
ZOOL 412	Parasite Immunology	ZOOL 212	2 (1+0+1)
ZOOL 413	Entomology and Environmental-Health	ZOOL 311	2 (1+0+1)
ZOOL 434	Renal Physiology	ZOOL 332	2 (1+0+1)
ZOOL 435	Neurophysiology	ZOOL 332	2 (1+0+1)
ZOOL 436	Reproductive Physiology	ZOOL 332	2 (1+0+1)
ZOOL 441	Histochemistry	ZOOL 245 ZOOL 262	2 (1+0+1)
ZOOL 455	Genetic Engineering	ZOOL 342 ZOOL 352	2 (1+0+1)
ZOOL 456	Bioinformatics	ZOOL 342	2 (1+0+1)
ZOOL 457	Cytogenetics and Cell Culture	ZOOL 242 ZOOL 352	3 (2+0+1)
ZOOL 458	Human Genetics	ZOOL 342 ZOOL 352	2 (1+0+1)
ZOOL 462	Experimental parasitology	ZOOL 212	2 (1+0+1)
ZOOL 464	Biotechnology	ZOOL 424	2 (1+0+1)
ZOOL 466	Industrial Environmental Pollution	ZOOL 375	2 (1+0+1)
ZOOL 480	Wildlife Protection	ZOOL 373	2 (2+0+0)
ZOOL 481	Venomous Animals	ZOOL 327	2 (1+0+1)
ZOOL 482	Organic adaptations of Chordates	ZOOL 103	2 (1+0+1)
<b>Total of Credit Hours</b>			<b>41</b>

(B) Elective courses from Botany and Microbiology Department			
Course Code	Course Title	Pre-req.	Credits (Lect. Exre. – Pract.)
BOT 212	Plant Anatomy	BOT 102	4 (2+0+2)
BOT 222	Principles of Flowering Plants Taxonomy	BOT 102	3 (2+0+1)
BOT 231	Economic Botany	BOT 102	2 (2+0+0)
BOT 241	Plant ecological factors	BOT 102	3 (2+0+1)
BOT 263	Archegonate	BOT 102	2 (1+0+1)
BOT 345	Flora of Saudi Arabia	BOT 102	2 (1+0+1)
BOT 384	Phycology	BOT 102 or MBIO 140	3 (2+0+1)
BOT 442	Hot desert ecology	BOT 102	1 (1+0+0)
BOT 444	Ecological resources	BOT 102	2 (1+0+1)
BOT 487	Phytoplanktome	BOT 102	2 (1+0+1)
BOT 488	Lichens	MBIO 140	2 (1+0+1)
MBIO 250	Virology	MBIO 140	3 (2+0+1)
MBIO 260	General Bacteriology	MBIO 140	3 (2+0+1)
MBIO 270	General Mycology	MBIO 140	3 (2+0+1)
MBIO 340	Microbial ecology	MBIO 140	3 (2+0+1)
MBIO 344	Sanitation and water microbiology	MBIO 140	2 (1+0+1)
<b>Total of Credit Hours</b>			<b>42</b>



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**List of service courses to other Specialization or College.**

Course Code	Course Title	Credits (Lect. – Exer. - Pract.)	Pre-Req.	Specialization /College of
<b>ZOOL 103</b>	Principles of general Zoology	3 (2+0+1)	-	Agriculture
<b>ZOOL 145</b>	Biology	3 (2+0+1)	-	Health Science
<b>ZOOL 352</b>	Principles of Genetics	2 (1+0+1)	-	BCH

**Short Courses Description**

**I- Compulsory courses from the Specialization** [credit hours (Lect. – Exer. – Pract.)]

<b>ZOOL 103</b>	<b>Principles of General Zoology</b>	<b>3 (2+0+1)</b>
Study of structure of animal cell. Tissues, General characters of animal Kingdom. Classification of animal Kingdom. Study of Protozoa with selected examples. General characters and classification of different phyla of animal Kingdom with selected examples. Introduction of physiology: Nutrition, digestion and metabolism, blood (structure and function).		
<b>ZOOL 212</b>	<b>Parasitology</b>	<b>3 (2+0+1)</b>
Understanding and practicing the different methods and techniques applied for identification of parasitic infections. Identification of the main characteristics of the different stages of the parasites. How to determine: the site of infection, diagnosis and diagnostic stages, pathogenicity and treatment. How to elucidate the life cycle of a parasite (host (s) and mode of transmission). Mastering photography, measurements and report writing.		
<b>ZOOL 242</b>	<b>Cell Biology and Physiology</b>	<b>3 (2+0+1)</b>
The emergence of modern cell biology. Prokaryotic and eukaryotic cells. Biological membranes : Their structure and function. Transport across membranes. Signal transduction. Protein targeting. Cell organelles: Structure and function. Cytoskeletal system. Cell cycle. Apoptosis. Stem cells. Glycolysis. Krebs cycle. Oxidative phosphorylation.		
<b>ZOOL 245</b>	<b>Histology</b>	<b>2 (1+0+1)</b>
Major classes of animal tissues including the epithelial, connective, muscular and nervous tissues. The various classes of animal tissues involved in the structure of digestive, respiratory, urinogenital, vascular, nervous and gland systems and the relationship between these structures and their functions.		
<b>ZOOL 262</b>	<b>Microtechniques</b>	<b>2 (1+0+1)</b>
The different types of chemical fixatives: their advantages and disadvantages. Steps used in animal microtechniques and how to stain specimen with chosen dyes. Steps used in preparing and staining of animal tissues for electron microscopy.		
<b>ZOOL 305</b>	<b>Modern Animal Taxonomy</b>	<b>2 (1+0+1)</b>
General principles of Animal Taxonomy. History of Taxonomy. The objectives of Taxonomy and the Task of the Taxonomist. The contributions of Taxonomy to Biology. Theories of Taxonomy. Species and Subspecies Categories. The hierarchy of categories and the higher Taxa. Animal population and their Diversity, Dynamic of Reproductive Isolation. Taxonomic characters. Procedures of Classifications, Morphological, Numerical, Molecular DNA hybridization, Chemotaxonomy, Immunotaxonomy and Cytotaxonomy. Taxonomic discrimination or individual variation. The		



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measurement procedures of Taxonomy, presentation of the Taxonomic findings. Descriptions, keys (Definition, types of keys,...etc.), publication. Quantitative analysis includes statistical analysis of individual variations. Principles of ZOOlogical Nomenclature. Interpretation of the rules of Nomenclature.

<b>ZOOL 311</b>	<b>General Entomology</b>	<b>3 (2+0+1)</b>
General considerations and introductory study of insects. General characters of insects. External structure: Integument structures and functions, Head thorax and abdomen. Internal structure (Anatomy): Alimentary canal, Excretory system, Respiratory system, Nervous system, Endocrine system and hormones, Reproductive system, Circulatory system. Insect growth and development (Metamorphosis): Eggs and fertilization, Types of larvae, Types pupae. General Taxonomy of insect: Apterygota, Pterygota (Exopterygota, Endopterygota).		
<b>ZOOL 317</b>	<b>Medical Arthropods</b>	<b>3 (2+0+1)</b>
Morphology, Classification, Biology and host-parasite relationships of minor medical importance such as Cockroaches, beetles, ants, wasps, moths, and those of major medical importance, such as Blood sucking including <u>Order Hemiptera</u> , F. Cimicidae e.g. Bed bugs; <u>Order: Anoplura</u> , F. Pediculidae (body louse); <u>Order: Diptera</u> , Suborder Nematocera, F. Ceratopogonidae (biting midges), F. Simuliidae (black flies), Psychodidae (sand flies) and F. Culicidae (mosquitoes); Suborder Brachycera, F. Rhagionidae (snipe flies), F. Tabanidae (horse flies); Suborder Cyclorrhapha, Calliophoridae (blow flies), Sarcophagidae (flesh flies), Muscidae (house flies), Glossinidae (tse tse flies) and Hippocidae (louse flies); <u>Order: Siphonaptera</u> (fleas). <u>Order: Acariformes</u> (mite-borne diseases); <u>Order: Acarina</u> (ticks and associated diseases). Venoms, Defense secretions and Allergens of arthropods. Epidemiology of selected pathogens causing indigenous diseases in Saudi Arabia. Control and Personal protections of arthropod pests.		
<b>ZOOL 320</b>	<b>Ichthyology</b>	<b>2 (1+0+1)</b>
Introduction, Classification of fish. Fish Ecology. External feature. Skin structure. Internal structure: Muscular system, Digestive system, Circulatory system, Respiratory system, Urinogenital system, Nervous system and Endocrine glands, Skeletal system. Growth and age. Migration and Fish ZOOlogy.		
<b>ZOOL 325</b>	<b>Ornithology</b>	<b>2 (1+0+1)</b>
Historical introduction. Economic advantages of birds. Effects of birds in environmental balance. Bird's morphological structure. Energy for feather molting. Mechanisms of maintenance of body temperature in birds compared to mammals. Common diseases in birds. Birds migration. Reproductive behavior in birds. Young care. Bird's classification. Development and conservation of birds.		
<b>ZOOL 326</b>	<b>Mammology</b>	<b>2 (1+0+1)</b>
Classification and historical view of mammals, Study some body organs, Characterized to mammals, anatomically and functionally, and their responses to different influences, these organs include hair, mammary gland, sweat glands, scent glands, mastication system, peripheral skeleton. Study some orders of mammals.		
<b>ZOOL 327</b>	<b>Herpetology</b>	<b>3 (2+0+1)</b>
Introduction. Structure of Amphibians and Reptiles. Origin of Amphibians & Reptiles. Reproduction and life history of Amphibians & Reptiles. Homeostasis. Relation to Biotic Environment. Amphibians and Reptiles of Saudi Arabia.		
<b>ZOOL 332</b>	<b>General Physiology</b>	<b>3 (2+0+1)</b>





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Studying the physiological functions, structure fitting function hormonal and neural control of different body systems in mammals including digestive, cardio-vascular blood, respiratory, excretory and male and female reproductive systems.

<b>ZOOL 342</b>	<b>Molecular Biology</b>	<b>2 (1+0+1)</b>
The characteristics of genetic material. DNA as the genetic material and RNA as the genetic material in some viruses. DNA structure and gene concept at the molecular level. DNA organization in chromosomes and DNA replication. Gene expression concept (Transcription, RNA processing and translation). Regulation of gene expression in prokaryotes. Introduction to regulation of gene expression in eukaryotes.		
<b>ZOOL 352</b>	<b>Principles of Genetics</b>	<b>2 (1+0+1)</b>
Fields of genetics. The relationship between genes and traits. Genetics is an experimental science. The chromosomal basis of inheritance (Chromosomes, cell cycle, mitosis, meiosis and chromosome theory). Mendelian inheritance and its extensions. Non-mendelian inheritance. Mutations, mechanisms of DNA repair and sex-determination in eukaryotes. Introduction to genetic engineering and its applications.		
<b>ZOOL 373</b>	<b>Terrestrial Ecology</b>	<b>2 (1+0+1)</b>
Introduction (Concept of Ecology). Components of Ecosystem. The cycles of elements. Terrestrial biomes. ZOOLgeographical distribution of animals. Physical ecological factors (Temperature, Light, Humidity). Biological ecological factors (Symbiosis). Animal adaptation to desert environments.		
<b>ZOOL 374</b>	<b>Aquatic Ecology</b>	<b>2 (1+0+1)</b>
Introduction. Characters of aquatic ecology. Water characteristics: Physical characters (Temperature, Salinity, Turbidity), Chemical characters (Dissolved Oxygen, Other dissolved gases, pH, Hardness). Aquatic ecosystem: Aquatic plants, Aquatic animals.		
<b>ZOOL 375</b>	<b>Pollution</b>	<b>2 (1+0+1)</b>
Study of air, water, soil and feed pollution and their effects on cellular and physiological structure of the animal. Control of pollutants, pollution in Saudi Arabia and other Gulf countries.		
<b>ZOOL 420</b>	<b>Comparative Vertebrate Anatomy</b>	<b>2 (1+0+1)</b>
Reviewing anatomical terms, historical brief, methods of studying this science and its importance. Comparative anatomy of the skin and skeletal systems of vertebrate classes.		
<b>ZOOL 423</b>	<b>Principles of Descriptive Embryology</b>	<b>2 (1+0+1)</b>
General principles of stages the embryo passes throughout its development as: gamete formation, fertilization, cleavage, gastrulation, formation of the three embryonic layers, organogenesis, comparative study of organs formation in different embryos.		
<b>ZOOL 424</b>	<b>Principles of Experimental Embryology</b>	<b>2 (1+0+1)</b>
An introduction and historical background about experimental embryology, development theories, cellular differentiation, embryonic induction, embryonic organizers, congenital malformations of embryos, embryonic tissue culture, parthenogenesis, artificial insemination, some applied studies on embryos (twins production, embryo aggregation, stem cells).		
<b>ZOOL 425</b>	<b>Economic Fishes and Crustaceans</b>	<b>2 (1+0+1)</b>



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Introduction. Economic Fishes: Fresh water fishes, Marine water fishes, Brackish water fishes. Most important fishes can be cultured in Saudi Arabia. Reproduction and life cycle of chosen examples of fishes. Economic Crustaceans. Reproduction and life cycle of chosen examples of Crustaceans. Principles of fish and Crustaceans culture: Aquariums, Water, Nutrition. Processes of Aquaculture.		
<b>ZOOL 432</b>	<b>Endocrinology</b>	<b>2 (1+0+1)</b>
Brief study on hormones or chemical messages with examples. Chemical structure of hormones. Study of the endocrine gland system in some animals.		
<b>ZOOL 433</b>	<b>Immunology</b>	<b>2 (1+0+1)</b>
Basic knowledge of immunology. Topics include: history and definitions in immunology, structure of the immune system innate versus acquired immunity, differences between active, passive and adoptive immunity, characteristics of the immune response, cells and mediators involved in the acquired immune response, humoral and cellular immunity. Hypersensitivity, innate, acquired and auto immunodeficiency.		
<b>ZOOL 461</b>	<b>Laboratory Technology</b>	<b>2 (0+0+2)</b>
Safety guidelines in laboratories. Experimental animals. Water properties as a solvent. pH and buffers. Techniques of particles separation colorimetric. Amino acids separation by chromatography. Separation of alkaline phosphatase from kidney. Estimation of total protein in serum. Study of carbohydrate metabolism. Estimation of hormones concentration by RIA and ELISA. Electrophoresis of blood proteins. Urine, fecal and semen analysis. Examinations of antibiotics. Blood properties. ESR and Stickle cell anemia.		
<b>ZOOL 465</b>	<b>Field Studies</b>	<b>5 (0+0+5)</b>
Providing student with various habitats of animals with studying the major environmental factors, also, providing with the existence of wild and aquatic animals. Acquiring the methodologies of field work, preparation of field reports of regions and the field research report, field visits to some Governmental and private establishments that have applicable relation to animal science.		
<b>ZOOL 471</b>	<b>Animal Behavior</b>	<b>2 (1+0+1)</b>
Introduction to animal behavior, and types of behavior. Natural selection and behavior. Ecology and adaptive behavior. Foraging behavior for foods. Genetics and behavior. Altruism and instinct behavior. Living in groups and their types. Cooperative behavior. Social behavior. Anti-predators behavior. Hormones and behavior. Nervous system and behavior. Communication in animals. Learning and experiments. Intelligence and behavior regions.		
<b>ZOOL 497</b>	<b>Practical training in zoology</b>	<b>2 (0+0+2)</b>
<b>Training students on the devices and technologies in the field of specialization such as:</b> <ul style="list-style-type: none"> <li>- A PCR reaction</li> <li>- A pattern of DNA analysis Squeneer</li> <li>- A minute of DNA Microarray</li> <li>- Appreciation of the ways the radiological immune system (ELISA)</li> <li>- A sperm Analyzer</li> <li>- A trading flour for gametes and embryos Micromanipulator</li> <li>- Give the student the skill of how to extrapolate and record the results of research.</li> <li>- Train and prepare students to access databases and sources of learning related to the specialization.</li> <li>- Preparation and report writing lab and how to draw the conclusions and recommendations.</li> <li>- The preparation and presentation of research results (PPT)</li> </ul>		



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<b>ZOOL 498</b>	<b>Graduation Research Project</b>	<b>2 ( 0+0+2 )</b>
Use of scientific periodicals. Looking for information in various information sources. Designing and executing practical experiments. Analysis of results. Writing the scientific reports.		

**II- Compulsory courses from OUTSIDE the Specialization** [credit hours (Lect. – Exer. – Pract).]

<b>BCH 101</b>	<b>General biochemistry</b>	<b>4 (3+0+1)</b>
Cell structure and organelle function. Biological buffers. Amino acids. Peptides and proteins-structures, properties and functions. Enzymes and coenzymes. Metabolism. Nucleic acids and protein biosynthesis. Hormones, role in metabolism. Vitamins and nutrition. Biomembranes, role in biological transfer. Biochemistry of blood.		

<b>BOT 102</b>	<b>General Botany</b>	<b>3 (2+0+1)</b>
Benefitting College: Science, Education, Agriculture. Plant and its importance. Chemical and fine structures of the plant cell. Metabolism. Plant water relations. Heredity and its applications. Levels of structure organization and evolution in plants (structure, taxonomy, economical and biological importance). Plant morphological and anatomical adaptation to environment Environmental pollution.		

<b>CHEM 103</b>	<b>General Chemistry (1)</b>	<b>3 (3 +0+0)</b>
<b>Stoichiometry:</b> SI units, chemical formulas, the mole, methods of expressing concentration, calculations based on chemical equations. <b>Gases:</b> Laws, Kinetic theory, deviation and van der Waals equation. <b>Thermo chemistry:</b> Types of enthalpy changes, Hess Law and its applications, first law of thermodynamics. <b>Solutions:</b> Type of solutions and laws related, colligative properties. <b>Chemical Kinetics:</b> Law of reaction rate, reaction order, factors affecting the reaction. <b>Chemical Equilibrium:</b> Reaction between $K_c$ & $K_p$ Le Chatelier's principle and factor affecting equilibrium. <b>Ionic equilibrium:</b> Acid and base concepts, pH calculations of acid, base and buffer solutions.		

<b>GEO 105</b>	<b>Introduction to Geology</b>	<b>2 (2+0+0)</b>
Earth science. Earth structure. Earth sphere (lithosphere, hydrosphere, atmosphere and biosphere). Soil (constituents, formation, physical characteristics and types). Factors limiting distribution of organisms. Organisms interactions (negative and positive). Introduction in fossils comprise: Conditions of fossilization. Processes of fossilization. Modes of preservation. Fossil record. Index fossil. Importance of fossil studies. Taxonomy and nomenclature. Study the important fossils in the record like: microfossils, invertebrate fossils, vertebrate fossils, palynology (the study comprise: Morphology, Taxonomy classification, Depositional classification, Behavioral classification, Index genus, Historical geology, Paleoecology). Theory of evolution. Evidences and causes of evolution. Extinction. Rates of evolution and extinction. Ecological changes cause the extinction. Protection of endangered animals and plants.		

<b>STAT 106</b>	<b>Biostatistics</b>	<b>2 (1+1+0)</b>
Descriptive statistics: Quantitative and descriptive data graphic presentation, Central tendency, measures of dispersion, simple probability rules, random variable, binomial distribution, Poisson distribution, normal distribution and its applications, confidence interval of the mean and percentage.		

<b>MBIO 140</b>	<b>Microbiology</b>	<b>3 (2+0+1)</b>
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Benefiting College: Science. Introduction to microbiology, sterilization, groups of microorganisms, their habitats, structure, nutrition, growth and reproduction, relationship with other organisms, their economic importance.

<b>PHYS 205</b>	<b>Biophysics</b>	<b>2 (2+0+0)</b>
Fluids flow and it's relation with biological systems, Blood pressure, concept, terms, methods of measurement, Atmospheric Pressure, Surface tension and viscosity, Thermodynamics of living systems and it's applications, Ultrasound waves, production and it's applications, Active and passive bioelectric properties, the action potential nature, and main properties, Non ionic radiation for radio waves, microwaves and infrared waves radiation, visible light, ultraviolet waves, laser, ionic radiation and methods of detections, radiation doses, Biological radiation effects, radiation genetic code effects, nuclear and radiation medicine.		

**III- Elective courses from the Specialization** [credit hours (Lect. – Exer. – Pract).]

<b>ZOOL 355</b>	<b>Wildlife Animal Genetics</b>	<b>2 (2+0+0)</b>
Animal genetic diversity concept. Loss of genetic diversity and its effects on the population. Population size and its effects on the survival of species (Genetic drift, inbreeding and the reduction in gene flow). Genetic erosion and genetic diversity. Methods used in genetic diversity conservation (Ex situ and in situ conservation). Population augmentation. Gene pools and endangered animal species.		
<b>ZOOL 366</b>	<b>Management of fish culture</b>	<b>2 (1+0+1)</b>
Introduction. Aquarium management: Aeration, Draining, Cleaning. Management of water quality: Water monitoring, Water analysis. Production management: Fry production, Fattening, Harvest. Nutrition management: Natural feeding, Artificial feeding, Nutrition methods, Nutrition rates. Marketing: A life marketing, Ice packing or freezing marketing, Market monitoring.		
<b>ZOOL 381</b>	<b>Economics of Aquaculture</b>	<b>2 (1+0+1)</b>
Introduction. Fisheries and aquaculture. The need for fish culture. Contribution of fish culture in food security. Project planning and economic benefits. The main factors in selection of the site of the project : Water resources, Soil, Location topography, Surface water sources. Obstacles of developing fish culture. The future of fish culture in the Arabian world.		
<b>ZOOL 382</b>	<b>Entomofauna of Saudi Arabia</b>	<b>2 (1+0+1)</b>
Biodiversity of Arabian desert and adaptation of insects to desert life. Study of the Biology, Bionomics and distribution of the most important insect species established in Saudi Arabia. Field collection of insects in selected ecological communities from the diversity of life zones comprising Saudi Arabia governorates. Identification and mounting of field collected insect.		
<b>ZOOL 412</b>	<b>Parasite Immunology</b>	<b>2 (1+0+1)</b>
Basic biology of parasites. Introductory immunological information about innate adaptive immune responses. Immunological aspects of certain endemic parasites in K.S.A. including ways in which the immune response can mediate pathology as well as protection. Laboratory assays for antigen preparation and serological diagnosis.		
<b>ZOOL 413</b>	<b>Entomology and Environment-Health</b>	<b>2 (1+0+1)</b>



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A study of the fascinating world of insects and their impact on human health and environment. Arthropods causing nuisance and phobias. Qualifications and abundance of insects (Terrestrial and Aquatic insects). Insect life cycle and seasonal abundance. Range of activity and distribution. Beneficial insects to human, Animals and plants. Insects attacking plants: (Injury by feeding and by oviposition). Insect pests of stored products. Negative and positive affinity of insects on environment and health.

<b>ZOOL 434</b>	<b>Renal Physiology</b>	<b>2 (1+0+1)</b>
Anatomical structure of the excretory system in mammals, Kidney functions and diseases. Glomerular filtration rate and its hormonal control. Juxta-glomerular apparatus, renal dialysis, steps of urine formation.		
<b>ZOOL 435</b>	<b>Neurophysiology</b>	<b>2 (1+0+1)</b>
Coordination and integration between nervous and endocrine systems. Nervous tissue, neural receptors. Synapses. Initiation and conduction of neural impulses. Reflex action. Divisions of the nervous system and functions of each part.		
<b>ZOOL 436</b>	<b>Reproductive Physiology</b>	<b>2 (1+0+1)</b>
Anatomical structure of the mammalian reproductive system. Physiology of reproduction in males including puppetry, determination and differentiation of sex and spermatogenesis. Oogenesis. Reproductive cycles in females. Fertilization.		
<b>ZOOL 441</b>	<b>Histochemistry</b>	<b>2 (1+0+1)</b>
The theoretical and practical basis for the detection of chemicals existed in animal tissues including starch, protein, fat, amino acids, nucleic acids, various enzymes, pigments and minerals.		
<b>ZOOL 455</b>	<b>Genetic Engineering</b>	<b>2 (1+0+1)</b>
An introduction treatment to genetic engineering. The course covers a definition of the term, Human Genome Project, gene therapy, biotechnology and genetically-engineered agriculture and genetically-modified animals and food. Basic overview of some aspects of the genetic engineering debate and legislation.		
<b>ZOOL 456</b>	<b>Bioinformatics</b>	<b>2 (1+0+1)</b>
An introduction to computational biology and bioinformatics. Data analysis, protein and nucleic acid sequence analysis, genome sequencing and assembly, protein structure prediction, analysis of DNA microarray data, data clustering, biological pattern recognition, and biological networks. Online applications of bioinformatics web-based tools and softwares.		
<b>ZOOL 457</b>	<b>Cytogenetics and Cell Culture</b>	<b>3 (2+0+1)</b>
Sterilization and aseptic techniques. Media types and media preparations. Cell separation and culturing. Chromosome structure and terminology. Chromosomal variations and aberrations. Karyotyping and staining technologies (Silver staining, G-and C-bands, FISH and SKY).		
<b>ZOOL 458</b>	<b>Human Genetics</b>	<b>2 (1+0+1)</b>
Pedigree analysis and modes of mendalian inheritance in humans. Non-Mendelian inheritance (Mitochondrial inheritance, anticipation, genomic imprinting and dosage compensation). Twin studies and their genetic applications. Chromosomal aberrations and syndromes. Multifactorial inheritance and common genetic diseases in human. consanguineous marriages. Genetic counseling.		
<b>ZOOL 462</b>	<b>Experimental Parasitology</b>	<b>2 (1+0+1)</b>



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Study of parasitism which include topics in biology of parasites, biochemistry and ecology. Laboratory methods including: experimental design, collecting and processing host and parasite samples, handing and identification of parasites, methods used to produce experimental infection to assess immunoprophylactic potentials of some parasitic antigens and therapeutic potency of certain drugs and biological materials.

<b>ZOOL 464</b>	<b>Biotechnology</b>	<b>2 (1+0+1)</b>
Definitions. Field and methodologies of biotechnology. Genetic engineering. Applications of biotechnology in agricultural, medical and industrial fields. Prospects and possible risk of biotechnology.		
<b>ZOOL 466</b>	<b>Industrial Environmental Pollution</b>	<b>2 (1+0+1)</b>
Introduction, Industrial pollution: sources, types and causes of occurrence in terrestrial and marine environments, chemical industry, heavy metals, sewage treatment, radioactive waste, pesticides and fertilizers. Adverse impacts of industrial pollution on the environment and wildlife. Strategic control. Standards and legislation. Monitoring industrial pollutants. Prevention, reduction and removal of industrial pollution. Industrial study cases : petrochemicals, fertilizers, petroleum.		
<b>ZOOL 480</b>	<b>Wildlife Protection</b>	<b>2 (2+0+0)</b>
Introduction. Animal geographical distribution. Role of animals in ecological balance. Importance of wildlife conservation. Reasons of organisms extinction. Role of local and international organization in animal conservation. Legislations and systems for wildlife protection. Wildlife animals in Arab Peninsula. Reared and endangered species. Wildlife management.		
<b>ZOOL 481</b>	<b>Venomous Animals</b>	<b>2 (1+0+1)</b>
Biology of venomous animals. Venom apparatus structure. The chemistry and toxicity of venomous animals. Protection and Treatment of venoms. Effects of venomous animals of Saudi Arabia.		
<b>ZOOL 482</b>	<b>Organic Adaptations of Chordates</b>	<b>2 (1+0+1)</b>
Studying several systemic organs such as skin, skeleton, heart, kidney... & others in groups of the chordates to show their functional skills that enable the chordates to live in their environment with less pressure of the stimuli.		

#### **IV- Elective courses from OUTSIDE the Specialization**

[credit hours (Lect. – Exer. – Pract).]

<b>BOT 212</b>	<b>Plant Anatomy</b>	<b>4 (2+0+2)</b>
Types of plant cells and tissues. Primary plant body. Secondary plant body. Secretory structures. Ecological anatomy.		
<b>BOT 222</b>	<b>Principals of Flowering Plants Taxonomy</b>	<b>3 (2+0+1)</b>
History of plant taxonomy (artificial, natural phylogenetical). Taxonomic units. Taxonomic sources. Methods of classification and nomenclatural rules.		
<b>BOT 231</b>	<b>Economic Botany</b>	<b>2 (2+0+0)</b>
General study of plants of economic importance and their products. Fats, Oils fibers, tannins, dyes, resins, Latex, rubber and paper. Medicinal plants and cereals.		
<b>BOT 241</b>	<b>Plant Ecological Factors</b>	<b>3 (2+0+1)</b>
Concept of ecology. Introduction of ecological factors. Climatic factors, biotic factors and soil factors.		



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<b>BOT 263</b>	<b>Archegoniate</b>	<b>2 (1+0+1)</b>
Evolutionary study of structure, reproduction and life history of Hepatophytes, Bryophytes, Vascular plants and Gymnosperms.		
<b>BOT 345</b>	<b>Flora of Saudi Arabia</b>	<b>2 (1+0+1)</b>
Historic and evolutionary introduction to the study of plant groups in the Arabian peninsula. Relief and climate of vegetational zones in Saudi Arabia. Natural vegetation Provinces in Saudi Arabia. Floristic composition. Types of habitat and their vegetation. Life forms, endangered and rare species.		
<b>BOT 384</b>	<b>Phycology</b>	<b>3 (2+0+1)</b>
Classification of algae, vegetative structure reproduction and life cycle. Biological and ecological importance. Ecology of algae. BOT 102 or MBIO 140		
<b>BOT 442</b>	<b>Hot Desert Ecology</b>	<b>1 (1+0+0)</b>
The concept of desert from ecological point of view. Desert types of the world and their effects upon the wild plants. The reflection of desert climate on the vegetation. Desertization as an environmental problem.		
<b>BOT 444</b>	<b>Ecological Resources</b>	<b>2 (1+0+1)</b>
Concepts of the various ecological resources including: (a) renewal, (b) nonrenewal, (c) dynamic and (d) stable. Productivity of natural ecosystems. Dangers underlying ecosystems and ways of their prevention. Depletion of ecological resources, reasons and means of its prevention.		
<b>BOT 487</b>	<b>Phytoplankton</b>	<b>2 (1+0+1)</b>
Fresh water and marine phytoplankton, mechanism of sinking and floating factors effecting their growth. Seasonal succession, interactions with other organisms, primary production.		
<b>BOT 488</b>	<b>Lichens</b>	<b>2 (1+0+1)</b>
Identification of lichens, morphological and internal structures, ecology and distribution, reproduction, commercial uses.		
<b>MBIO 250</b>	<b>Virology</b>	<b>3 (2+0+1)</b>
Characteristics of viruses, structure and classification of animal and bacterial viruses, cultivation and purification of viruses, chemistry of viruses.		
<b>MBIO 260</b>	<b>General Bacteriology</b>	<b>3 (2+0+1)</b>
The bacterial groups; their characteristics and methods of classification.		
<b>MBIO 270</b>	<b>General Mycology</b>	<b>3 (2+0+1)</b>
Study of fungi structure, growth, methods of reproduction of classification.		
<b>MBIO 340</b>	<b>Microbial ecology</b>	<b>3 (2+0+1)</b>
Behavior of microorganisms in their natural habitats emphasizing the interactions among them and with other organisms. Their role in biodegradation, recycling of matter and energy flow.		
<b>MIC 344</b>	<b>Sanitation and water microbiology</b>	<b>2 (1+0+1)</b>
Methods of the study of the contents of microorganisms in water and role of these microorganisms in the water treatment.		



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**V- Service Courses to Other Specialization and Colleges** [credit hours (Lect. – Exer. – Pract).]

<b>ZOOL 103</b>	<b>Principles of General Zoology</b>	<b>3 (2+0+1)</b>
Study of structure of animal cell. Tissues, General characters of animal Kingdom. Classification of animal Kingdom. Study of Protozoa with selected examples. General characters and classification of different phyla of animal Kingdom with selected examples. Introduction of physiology: Nutrition, digestion and metabolism, blood (structure and function).		
<b>ZOOL 352</b>	<b>Principles of Genetics</b>	<b>2 (1+0+1)</b>
Fields of genetics. The relationship between genes and traits. Genetics is an experimental science. The chromosomal basis of inheritance (Chromosomes, cell cycle, mitosis, meiosis and chromosome theory). Mendelian inheritance and its extensions. Non-mendelian inheritance. Mutations, mechanisms of DNA repair and sex-determination in eukaryotes. Introduction to genetic engineering and its applications.		

***Important Note: The student must review the department concerned for decisions that taught outside the college (Compulsory and Elective).***