## متطلبات المقررات الدراسية لدرجة البكالوريوس بقسم علم الحيوان

### 1- متطلبات الكلية ( 9 وحدة دراسية )

| رقم المقرر | اسم المقرر | الوحدات | متطلبات المقرر |
|---|---|---|---|
| 0010 | اللغة العربية | 3 | .... |
| 0101 | اللغة الانجليزية 1 | 3 | ..... |
| 0102 | اللغة الانجليزية2 | 3 | 0101 |

### 2- متطلبات المقررات الإجبارية المدعمة ( 40 وحدة دراسية)

| رقم المقرر | اسم المقرر | الوحدات | متطلبات المقرر |
|---|---|---|---|
| 1100 | رياضيات عامة 1 | 4 | ..... |
| 2002 | الإحصاء العام | 4 | ..... |
| 4100 | أساسيات الفيزياء (نظري) | 3 | ..... |
| 4104 | معمل الفيزياء العامة I | 1 | .... |
| 5103 | الكيمياء العامة I | 3 | ..... |
| 5104 | معمل الكيمياء العامة I | 1 | 5103 |
| 5105 | الكيمياء العامة II | 3 | 5104 – 5103 |
| 5106 | معمل الكيمياء العامة II | 1 | 5105 - 5104 – 5103 |
| 5211 | كيمياء تحليلية عملي | 1 | 5213 |
| 5213 | كيمياء تحليلية نظري | 2 | 5105 – 5106 |
| 5253 | كيمياء عضوية نظري | 2 | 5213- 5106 -5105 |
| 5254 | كيمياء عضوية عملي | 1 | 5253 |
| 5390 | كيمياء حيوية نظري | 2 | 5105- 5106 |
| 5391 | كيمياء حيوية عملي | 1 | 5390 |
| 7101 | علم النبات I | 4 | ..... |
| 7102 | علم النبات II | 4 | 7101 |
| 7141 | مدخل الأحياء الدقيقة | 3 | 7102 |

### 3- متطلبات المقررات الإجبارية ( 55 وحدة دراسية)

| رقم المقرر | اسم المقرر | الوحدات | متطلبات المقرر |
|---|---|---|---|
| 8100 | علم الحيوان 1 | 4 | |

| | | | |
|---|---|---|---|
| 8101 | علم الحيوان 2 | 4 | 8100 |
| 8200 | اللافقاريات الدنيا | 4 | 8101 |
| 8201 | علم الحبليات | 4 | 8101 |
| 8202 | علم الأنسجة | 3 | 8101 |
| 8203 | اللافقاريات العليا | 4 | 8200 |
| 8204 | علم الحشرات العام | 3 | 8203 |
| 8205 | التقنية الحيوانية | 2 | 8202 |
| 8300 | علم الخلية | 4 | 8101-5390 |
| 8301 | علم وظائف الأعضاء 1 | 4 | 8101-5390 |
| 8302 | علم الأجنة | 3 | 8201 |
| 8303 | أساسيات علم البيئة | 3 | 8101-7102 |
| 8304 | علم التطور | 2 | 8201-8203 |
| 8305 | علم الوراثة | 3 | 8300 |
| 8306 | علم وظائف الأعضاء 2 | 4 | 8301 |
| 8307 | علم الطفيليات العام | 3 | 8200 |
| 8415 | ندوه بحث | 1 | فصل التخرج |

## 4- متطلبات المقررات الاختيارية ينجز منها الطالب ( 22 وحدة دراسية)

| رقم المقرر | اسم المقرر | الوحدات | متطلبات المقرر |
|---|---|---|---|
| 8308 | علم تقسيم الحشرات | 3 | 8204 |
| 8309 | علم التشريح المقارن | 4 | 8201 |
| 8310 | علم الأسماك البحرية | 3 | 8201 |
| 8400 | المجهر الالكتروني | 2 | 8205 |
| 8401 | بيولوجية الخلية | 3 | 8300 |
| 8402 | علم البيولوجيا الجزيئية | 3 | 8300 |
| 8403 | كيمياء الأنسجة | 2 | 8202 |
| 8404 | علم الإشعاع الحيوي | 2 | 8305 |
| 8405 | علم الأجنة التجريبي | 3 | 8302 |
| 8406 | علم وظائف الأعضاء المقارن | 3 | 8306 |
| 8407 | علم الغدد الصماء | 3 | 8306 |
| 8408 | علم المناعة | 2 | 7141-5390 |

| | | | |
|---|---|---|---|
| 8409 | علم السموم | 3 | 8204-5253 |
| 8410 | علم سلوك الحيوان | 2 | 8306-8201 |
| 8411 | علم بيئة الحيوان | 3 | 8303 |
| 8412 | علم الحشرات التطبيقي | 3 | 8204 |
| 8413 | علم الحبليات الخاصة | 3 | 8101-8201 |
| 8414 | مواضيع خاصة | 3 | فصل تخرج |
| 8416 | مشروع بحث | 5 | 90 وحدة دراسية |
| 8417 | علم الحشرات الطبية | 3 | 8204 |
| 8418 | علم وظائف الحشرات | 3 | 8204-8301 |
| 8419 | دراسة مستقلة | 1 | فصل تخرج |
| 8420 | البيه الصحراوية | 3 | 8303 |
| 8421 | علم وظائف الأعضاء الخلية | 3 | 8300-8306 |
| 8422 | الايض والتغذية | 2 | 8301 |
| 8423 | علم الأوليات الطفيلية | 3 | 8307 |
| 8424 | علم الديدان الطفيلية | 3 | 8307 |
| 8425 | علم بيئة البحار | 3 | 8303-8203-8201 |
| 8426 | علم الوراثة الجزيئي | 3 | 8305 |
| 8428 | مدخل لعلم الفيروسات الحيوانية | 2 | 7141 |
| 8429 | علم الحشرات المائية | 3 | 8204 |
| 8430 | علم التلوث البحري | 3 | 8303 |
| 8431 | علم البرمائيات | 3 | 8201 |
| 8432 | علم تصنيف البرمائيات | 3 | 8431 |
| 8433 | علم وظائف أعضاء البرمائيات | 3 | 8306-8431 |
| 8434 | علم الزواحف | 3 | 8201 |
| 8435 | علم تصنيف الزواحف | 3 | 8434 |
| 8436 | علم وظائف أعضاء الزواحف | 3 | 8306-8434 |
| 8437 | علم الطيور | 3 | 8201 |
| 8438 | علم تصنيف الطيور | 3 | 8437 |
| 8439 | علم وظائف أعضاء الطيور | 3 | 8306-8437 |
| 8440 | علم الثدييات البرية | 3 | 8201 |
| 8441 | علم تصنيف الثدييات البرية | 3 | 8440 |
| 8442 | علم وظائف أعضاء الثدييات البرية | 3 | 8306-8440 |
| 8601 | علم الحيوان العام ( لطلبه علوم الأرض ) | 2 | ***** |
| 8602 | طفيليات واسماك | 3 | 8307 |

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|---|---|---|---|
| 8603 | مزارع اسماك | 3 | 8203-8201 |
| 8604 | تغذيه اسماك | 1 | 8301 |
| 8605 | المهارات العلمية لعلوم الحياة | 3 | 8101 |
| 8606 | أساسيات التقنية الجزيئية | 2 | 8300 |

## SYLLABUS OF ZOOLOGY توصيف مقررات قسم علم الحيوان

**ZOOLOGY. I 81001 علم الحيوان**

I. Cell Biology:1.The Cell concept, Cell theory, Prokaryotic & Eukaryotic cells, Cell structure. 2.The Cytoplasmic organelles: structure & function of (The Golgi apparatus, ribosome's; liposome's, endoplasmic reticulum, mitochondria). 3.The cell membrane (Ultra structure, Modification, Function). 4.The cellular metabolism ( Aerobic & Anaerobic respiration). 5.The Nucleus ( Structure),Nucleic acids, Protein synthesis. 6.Cell division ( Mitosis, Meiosis ),cell cycle. 7.Membrane Permeability 8.Facilitated diffusion 9.Active transport 10.Exchange of large particles across plasma membrane. 11.Osmosis: II. Histology:1.Epithelial tissues (Structure ,function, classification and location 2.Connective tissues (Structure ,function, classification and location 3.Muscular tissues( Striated, smooth, and cardiac muscles). 4.The nervous tissues (the neuron, the cell body and nerve fibers. 5.The blood( the shape and the count of erythrocytes and leukocytes). III. Mendelian Genetics: Mundelein method, Gene pairs, Mundelein laws (1&2), Test Cross, mutation, Sex-linkage. IV. Physiology: 1. Digestion and Absorption: Digestive system(Structure),digestion in mouth, swallowing, digestion in stomach, digestion in small intestine, digestion in large intestine, absorption. 2. Circulation: Open and closed circulatory systems, blood vessels, heart, composition of blood, function of blood, blood coagulation, blood groups, lymphatic system, defense mechanism. 3. Respiration: Structure of respiratory system, mechanism of respiration (inspiration expiration), gases exchange ( in lugs & tissues), transport of gases in blood. 4. Muscles: Types of muscles, contractile proteins, mechanism of muscle contraction and relaxation. 5. Excretion: Excretory substances, organs of excretion, mechanism of urine formation. 6. Nervous system: Nervous system and chemical co-ordination, structure of neuron, nerve impulse, neuro-muscular function, relax action, central, peripheral and autonomy nerve system, hormones and endocrine system, pituitary gland, hypothalamus, thyroid gland, adrenal gland, ovary and testis.

**ZOOLOGY. II 81012 علم الحيوان**

Theory: Phylogeny and systematic of organisms. Terminology definitions. Taxonomy, systematic, Classifications, systematization, taxon. Carolus Linnaeus hierarchical classification scheme. Binomial nomenclature, A trinomial name. Defining a species. Typological or morphological species concept, biological species concept, evolutionary species concept, phylogenetic species concept. The geographic range of a species, Evolutionary duration of a species. Organismal features,( characters), homologous, homoplasy, convergent evolution. Sorting Homology from Analogy, shared *primitive (ancestral)* character, shared *derived* character. Determining polarity of a character, out-group comparison, Clades, plesiomorphic, symplesiomorphy, cladogram, phylogenetic tree, Characters used to construct cladograms. Theory of taxonomy, Evolutionary taxonomy, Phylogenetic systematics Cladistics, monophyletic, paraphyletic, polyphyletic grouping. Molecular Systematic. Major Divisions of Life. Aristotle's two-kingdom system. Kingdom Protista for single-celled organisms Five-kingdom system. Three monophyletic domains above kingdom level—Eucarya, Bacteria and Archaea. Major Subdivisions of the Animal Kingdom:- Parazoa: phylum Porifera. Eumetazoa: Grade I (Radiata),phyla Cnidaria, CtenophoraGrade II (Bilateria): phyla Platyhelminthes, Gnathostomulida, Nemertea, phyla Rotifera, Gastrotricha, Kinorhyncha, Nematoda, Nematomorpha, Acanthocephala, Entoprocta, Priapulida, Loricifera, phyla Mollusca, Annelida, Arthropoda, Echiurida, Sipunculida, Tardigrada, Onychophora, phyla Phoronida, Ectoprocta, Chaetognatha, Brachiopoda, Echinodermata, Hemichordata, Chordata

**LOER INVERTERATES 8200 اللافقاريات الدنيا**

1. General characters of Invertebrates. 2. General classification of Invertebrates to different phyla.3.Meanings of the terms: Binomial nomenclature, Hierarchy of classification, Cell, Tissues, Organ. System, Dilolastic, Triloblastic, Asymmetry, Bilateral symmetry, Radial symmetry, Acoelomata, Pseudocoelomata , Coelomata, Autotroph, Heterotroh, Holozoic, Holohytic, Saprozoic, Hermaphrodite, Dioecious, Parthenogeneis, Binary fission, Multiple . Subkingdom Protozoa .4. Protozoa Phyla: General characters, classification up to Phyla, classes with 3 characters and one example of each class. Parasitic Protozoan's and their importance; conjugation in *Paramecium*. Subkingdom Metozoa. 5. Phylum Porifera: General characters, classification up to classes with 3 characters and one example of each class. Canal system and species in sponges; internal structure of *Leucosolenia* sp. 6. Phylum Cnidaria (Coelenterata): General characters, classification up to classes with 3 characters and one example of each class. Morphology and internal structure of *Hydra, Obelia, Aurelia, and Metridium*, Definition of Metagenesis, Polymorphism; Corals and their formations. 7. Phylum Ctenophora: General characters, classification up to classes with 2

characters and one example of each class; Affinities of Ctenophora taking *Pleurobrachia* sp as an example. 8. Phylum Platyhelminthes: General characters, classification up to classes with 3 characters and one example of each class. Brief life history of *Taenia*sp & *Faciola*sp; explanation of flame cells in *Planaria* sp. 9. Phylum Nematoda (ASchhelminthes): General characters, classification up to classes with 3 characters and one example of each class. General morphology of a Nematode and a Rotifer, Human parasitic Nematodes.

**CHORDATA 8201** **علم الحبليات**

Introduction: General plan of Chordates.Organization: Variety of Chordates, organ and ancestry. Classification: Group Protochordates (Acraniata): Subphylum Urochordata: External characters ;Body wall, arterial cavity and pharynx ,excretion, blood vascular system, nervous system, reproductive organs, structure and metamorphosis of tadpole larva and affinities. Example. *Ciona sp*. chordate characters manifest in the larval stage. Subphylum Cephlochordata: External characters ;Body wall, digestive tract, Circulatory system, Respiration system, Nervous system ,Coelom, Gonads. Example. *Amphioxus sp.,* atypical chordates having chordate characters in the larval as well as adult stage. Group Euchordates (Craniata): Subphylum Vertebrata:- chordates with head, brain and vertebral column, General characters, classification up to classes with 6characters and one example of each class. Super class Agnatha: (jawless fishes, first vertebrates). Class Cyclostomata. Order Myxinoidea: Example. Hagfishes. Order Petromyzontia: Example. Lampreys (*Petromyzon) .* Super class Gnathostomata: vertebrates with jaws that are modified gill arches and paired appendages. They include cartilaginous fishes, bony fishes and tetrapods. General characters, classification up to classes with 6characters and one example of each class. Fishes Class Chondrichthyes ( cartilaginous fishes) , General characters, classification up to subclasses with 3characters and one example of each subclasses, example Dogfish, External features ;Skeleton,, digestive tract, Respiration, Circulatory system, , Nervous system ,Organs of special sense, Excretion, and Reproductive organs. Class Osteichthyes: bony fishes, Skeleton contains bone, four pairs of gills, covered with operculum. Possess swim bladder or lung. Example Morgan, External features; Skin and Scales, General classification, and general account of Dipnoi. Tetrapods. Class Amphibia: e.g Rana (Toad), External features, Skin digestive tract, Respiration, Circulatory system, Nervous system, Organs of special sense, Excretion, and Reproductive organs. General classification up to orders, Metamorphosis in an amphibian and general account of neoteny. Class Reptiia: External organization and evolution of reptiles, classification of living reptiles and brief account of extinct reptiles. e.g. Alligator:

body covering, Circulatory, Respiratory System. Class Aves: e.g. Pigeon. External characters, feathers, coelom and viscera, digestive organs, Respiratory organs, Circulatory System, Nervous system sense organs urinogenital organs, classification of birds ,aerial adaptations. Class Mammalia: e.g. Rabbit ,General characters, and classification of mammals up to subclasses, External features ,Skin ,coelom, viscera, digestive system, Respiration, Circulatory system, Nervous system ,urinogenital system.

**HISTOLOGY 8202** **علم الانسجة**

Course objectives: This course consists of a detailed survey of mammalian histology involving both lecture/discussion and laboratory examination of sectioned tissues. Students who take this course will develop an in depth understanding of mammalian tissue structure/function. Part .I: An introduction and definition. A. Epithelial tissues: Types (Classification). 1.Covvering ( Squamous, Cuboidal, Columnar, Ciliated Columnar, Pseudostrified Columnar, Ciliated Pseudostratified Columnar, Stratified squamous, Stratified Cuboidal, Stratified Columnar, Ciliated Stratified Columnar, Transtional. 2. Glandular (Unicellular gland, multicellular glands, mode of secretion, endocrine glands, duct glands). 3. Sensory (nasal epithelium, retina of eyes, taste buds, inner ear epithelium). 4. Cuticulr (in skin) of worm. 5. Germinal (in gonads), modification of epithelial tissues: i – Cohesion specialized in epithelium. Ii- Surface specialized in epithelium, microvilli, stereocillia, cilia and basal enfolding. B- Connective tissues: 1. Proper (aerollar, fibrous, elastic, reticular, mucous, adipose). 2. Skeletal (cartilages and bones, development, bone marrow). 3.Vascular(mammalian, blood, non-mammalian blood, types of corpuscles, plasma, platelets, development ,clotting, blood transport, blood groups, function, Rhesus factor, lymph constituents).C- Muscular tissues: 1- Skeletal muscle fibers( Striated). 2- Unstriated muscle fibers. 3- Cardiac muscle fibers, minute structure of sarcomere, chemical structure, method of contraction of sarcomere. D- Nervous tissues: An introduction, development of N.S, neural cell differentiation, types of neurons and neuroglia, types of synapses, nerve fires, sciatic nerve, spinal cord, reflex arc. Part .II: Histology of organs and systems. Development of tissues and organogenesis: A. Nervous system: Development of N.S. C.N. C, P.N.S. Brain meanings ,cerebral cortex ,cerebellar cortex, olfactory bulb, choroid plexes, cranial nerves, cerebral ganglion, spinal cord and spinal nerves, sensory nerve endings, skin receptors, motor nerve endings, motor end plate, muscle spindle, tendonous spindle, autonornic nervous system, sympathetic and parasympathetic systems, sympathetic ganglion. B. Digestive system: Oral cavity, lip, tongue and taste buds, teeth, esophagus, stomach, small intestine, large intestine, appendix, colon, rectum, three salivary glands such as parotid, submaxilllary and

sublingual, pancreas, liver, gall bladder. C. Circulatory system: Structure of heart, blood route, purkinge fibers, blood vessels, blood capillaries, artery, vein. D. Lymphatic system: Lymph filtration, lymph components, lymphatic routes, lymphatic system, lymph organs, lymphatic nodules, lymph node, tonsil, spleen, thymus organ. E. Respiratory system: Nasal cavity, parnasal sinuses, nasopharynx, larynx, trachea and lung. F. Urinary system: Kidney (cortex, medulla and nephrons), urinary passage (pelvis, ureter, bladder and urthera). G. Endocrine system: Pituitary (anterior, intermediate and posterior lobes), pineal, thyroid, ultemobranchial, adrenal glands, and pancreatic islets.

**HIGHER INVERTEBRATA 8203** **اللافقاريات العليا**

1. General characters of higher invertebrate, classification. 2. Coelom and Coelomic formation, types of Coelom, function of Coelom, metamerism. 3. General characters, morphology and anatomy of minor phyla: Echinroidea, Sipunculoidea, Bryozoa, Brachiopoda, Phoronides, Chaetognatha, Hemichordata, Pogonophora. 4. General characters of Phylum Annelida, classification, morphology, anatomy and different systems and biology of *Nereis*sp, *Lumbricus*sp, and *Hirudo* sp. 5. General characters of Phylum Mollusca, classification, morphology, anatomy and different systems and biology of *Neopllina*sp, *Chiton* sp,*Dentalium*sp, *Helix*sp, *Anodonta*sp, *Sepia* sp. Torsion in Gastropoda, Shell formation and its chemistry, life history of *Anodonta* sp. Economic importance of Bivalves, General characters of Cephalopoda, Phylogeny of Mollusca. 6. General characters of Phylum Arthropoda, classification, Exoskeleton, body form, and jointed appendages, organs system ,digestive ,circulatory, respiration, excretory, nervous and reproductive systems. Life history parameters, morphology and anatomy of a spider, general characters of crustacea, classification, morphology and functional anatomy of a crayfish, larval forms of crustacea. Comparisons of Diplopoda and Chilopoda, general characters of insects; types of mouth parts, habitat variations, parasitic insects, social insects, economic relations of insects. 7. General characters of Phylum Echinodermata, classification. Pedicellaria and its function, body forms of Echinoderms, body wall and endoskeleton, water vascular system, reproductive and larval forms, regeneration.

**GENERAL ENTOMOLOGY 8204** **علم الحشرات العام**

1. Insects and related animals, insects and related Arthropods, Insect evolution (Origin of insects, insect phylogeny). 2. What is insect, segmentation and the divisions of the body of insects, significance of insects, insect colours, light and sound production. 3. The insect externally, the general insect plan (Tagmata, Head, Thorax, Legs, Abdomen). 4.The anatomy and physiology the integument, digestive system, circulatory system, tracheal ad muscular systems, excretory system, nervous system ad sense organs, endocrine glands,

reproductive system. 5. Development and metamorphosis: Embryology, postembryonic development, diapauses. 6. Insect ecology; the life system concept, population, relationship between environmental components and population, environmental components, biotic potential. 7. Behavior: Rhythms, locating food and initiating feeding, locating mats and copulation, migration. 8. The classification of insects: Components of biological classification, Taxonomic categories, nomenclature. Subclass Apterygotae insects: Zygentoma(Thysanura) & Archaeognatha. Subclass Pterygotae insects: Exopterygota insects: Ephemeroptera, Odonata, Plecoptera, Embioptera, Blattaria, hasmida, Mantodea, Orthoptera, Isoptera (Termites), Dermaptera, Psocoptera, Mallophaga, Siphunculata (Anoplura),Hemiptera,Homoptera,Thysanoptera. Endopterygote insects: Neuroptera, Coleoptera, Lepidoptera, Siphonaptera, Diptera, Hymenoptera, Mecoptera, Trichoptera.

**ZOOTECHNIQUE 8205** **التقنية الحيوانية**

1. Introduction for work in practical's; laboratory instructions, solution preparation (grades & alcohol, biological satins, fixatives), general laboratory aids (labeling, cleaning slides, removing; laboratory satins from hands and glassware). Laboratory safety, Types of zoological microscopic preparations. Types of microtome's (rotating microtome, freezing, cryostat), Microscopes, Knife sharpener. 2. (a) preparation a W.M. of a Coelenterate colony. (b) Preparation of culture for Protozoa. 3. Fixation, staining and mounting of parasitic Protozoa from the rectum of Toad.4. (a) Preparation of Amoeba, Ciliate from the Protozoan culture. (b) Demonstration of flagellum. 5. (a) Fixation and preparation of sponges. (b) Making a W.M. of the spicules of a sponge. (c) Collection and presentation of flatworm parasites from the alimentary canal of vertebrates 6. Satins and mounting of a Cestode, Trematode classes. 7. Making a squash preparation of:- (a) Testis of a Toad (b) Testis of an insect. 8. Check embryo whole mount early stage. 9. Toad embryo whole mount early stage. 10. Whole mounts with and without caustic of crustacean larvae, lice, flea or bedbugs. 11. Preparation of mouth parts of Cockroach, Housefly, and Mosquito. 12. Skeleton preparation of a Toad, Pigeon and Rabbit. 13. Alizarine bone staining technique. 14. Making a smear preparation of a Toad blood. 15. Preparation of paraffin sections: (a) Narcotization and animal dissecting. (b) Fixation, post fixation treatment. (c) Dehydration, clearing, infiltration and embedding in paraffin wax. (d) Trimming in paraffin block and fixing to the microtome holder (e).Cutting. (f). Staining: a) Hematoxylin and Eosin, b).Mallory tripe stain. c).PAS. 16. Principles of Histochemistry: Fixation, dehydration, embedding, crstaat sectioning. 17. Urine analysis for demonstration the

Epithelial cells, crystals. 18. Principles of taxidermy 19. Chart making 20. Bioplastic 21. Model making.

**CYTOLOGY 8300 علم الخلية**

1- Introduction history and general concepts of Cell Biology 2- General structure of the prokaryotic and Eukaryotic cells 3- Mo1ecular components and the metabolism or cell, Chemical component of the cell, proteins, lipids, carbohydrates, nucleic acids 4- Enzymes: Specificity, activation, active sites & regulation of enzymatic activity.5-Boenergetics and cell respiration, Energy, colloids and electrolytes, energy cycle and energy transformation, anaerobic glycolysis, aerobic respiration, Kreb's cycle, respiratory chain, oxidative phosphorylation. 6- Instrumental analysis of Biological structure. (a)Various types of Light Microscopy - interference, dark field and polarization microscopy X-ray diffraction, Electron, Microscopy. (b)Cytological and cytochemical analysis- cell fractionation, methods Cytochemical and histochemical staining methods and Autoradiography Cell culture. 7- Elementary units of Structure in Biological system- assembly of macromolecules and elementary membranous structures. 8- The Cell membrane and permeability; molecular organization of the cell. Membrane, Molecular mode cell permeability; Differentiation the cell surface and intercellular communications. 9- Properties of the cytoplasmic Matrix. 10- The cytoplasmic organdies Endoplasmic reticulum, Golgi complex, Mitochondria, Lysosomes Cell secretion. The plant cell and the Chloroplast, cell wall, plant cell cytoplasm, plastids, photosynthesis. 11- Theinterphasenucleus: Nuclear envelope, chromosomics, Nucleolus. 12- Cytochemistry of the nucleus, the cell cycle and DNA duplication. 13- Ribosomes - Chemical composition, structure & Biogenesis 14- Protein synthesis & Molecular genetics Genetic code, trans-cription of genetic information, RNA, tRNA, Ribosomes and protein synthesis. 15- Cell differentiation: General characteristics of cell differentiation, Nucleo-cytoplasmic interactions, and molecular mechanisms. 16- Cell movement, cilia, centrioles, microtubules & Microfilaments.

**PHYSIOLOGY I 8301 علم وظائف الأعضاء**

Chapter One: What is Physiology? The relations between physiology and other sciences. Physiology branches. Introduction to cytology. The relations between cytology and other sciences. Characters of living organisms. Chemical structures of cells. Cell types according to shape size and function. Structure and functions of cell organelles. Transport across membrane. Chapter 2: Body tissues. Structure and functions of tissues. Chapter 3: Circulatory system. Functions of blood. Structure of circulatory system. Blood. Physical properties of blood. Blood components. Blood components embryological origin. Red blood corpuscles. White blood cells. Blood platelets. Plasma. Homeostasis. Blood related

diseases. Cardiovascular system. Heart. Pulmonary circulation. Systemic circulation. Blood vessels. Conducting system. ECG. Blood flow in the heart. Cardiac cycle. Heart sounds. Cardiac output. Blood flow and blood pressure. Blood groups. Chapter 4: Homeostasis Chapter 5: Excitable tissues .Action potential. Chapter 6: Muscular tissue .Characteristics of muscular tissue. Structure and functions of muscular tissue. Physiology of muscle contraction. Source of energy in muscle contraction. Types of muscle contraction. Cardiac muscle. Chapter 7: Respiratory system. Respiratory system structure .Respiration. Gas exchange. Oxygen toxicity. Lung volumes. Chapter 8: Excretory system .Urinary system. Functions of nephrons. Urine formation .Acid – base balance .Acid – base imbalance. Chapter 9: Nervous system .The important functions of the Nervous system. Types of neurons according to their function. Types of neurons according to their structure. Nervous system divisions. The autonomic nervous system. Neurotransmitters in the autonomic nervous system. Receptors. Nervous tissue. Neuron structure. Impulse propagation .Types of impulses .Types of neurotransmitters.

**EMBRYOLOGY 8302 علم الاجنة**

The patterns and principles of normal embryonic and fetal development of mammals are covered with an emphasis on comparison to adult anatomy and medical implication In laboratories, the teratology of prenatal anomalies are also examined. There is a focus on gathering embryological information and developing scientific reasoning skills through assignments, a report, and group presentations.

**PRINCIPALS OF ECOLOGY 8303 اساسيات علم البيئة**

1- Introduction to Ecology and its relation to other branches of biology, biological spectrum, subdivisions of ecology. 2- Principles and concepts pertaining to Ecosystem. (a) Concepts or ecosystem, components of ecosystem, production and decomposition, Homoeostasis of the ecosystem. (b) Energy flow in an ecosystem, food chains & web Trophic levels, ecological Pyramids. (c) Biogeochemical cycles; gaseous and sedimentary cycles and quantitative study of biogeochemical cycles. 3- Principles pertaining to Limiting factors: (a) Liebig's law of minimum and Shelford's law of tolerance combined concept of limiting factors. (b) Factor compensation and ecotypes. 4- Review of important ecological or environmental parameters or factors: light, temperature, current & pressure, atmospheric gases, water, pH, nutrients and soil. 5- Principles and concepts pertaining to organization at population level: (a) Population group properties (Population density, natality mortality, population age. distribution, growth form, fluctuations, dispersal, and population structure. (b) Isolation, home range, territory. (c) Types of interaction between two species. 6- Principles and concepts pertaining to organization at community level: Biotic community

(intercommunity classification, ecological dominance, patterns in community, succession, stratification, trophic relations, ecotones and edge effect). 7-Pollution: Concept kinds of pollution and phases of waste treatment. 8-Gonservation of Natural Resources in general: Mineral resources Agriculture & Forestry, Wildlife management, Aquaculture, Desalinization and weather modification:

**EVOLUTION 8304** **علم التطور**

*- Historical background (Evolution before Darwin) - Linnaeus, Cuvier, catastrophism and Lamarck's theory of evolution. *-Darwin's theory of evolution: 1- Natural selection. 2- Examples of natural selection; (Bistonbetularia) moths in Manchester, using pesticides & insect resistance, and using of antibiotic.....etc 3- Sexual selection (Inter-sexual selection and Intra-sexual selection): - Before copulation, male- male competition and female choice. - After copulation, sperm competition and cryptic female choice. *- Evidence of evolution: 1.Biogeography 2.Fossil record 3.Compartive anatomy and homology. 4. Embryology. 5. Molecular biology. *- De vries mutation theory of evolution. *- The evolution of population and population genetics:- 1- Modern synthetic theory of evolution and Micro-evolution. 2- Hardy and Weinberg principle and genetic equilibrium. - causes of Micro-evolution: 1- Genetic drift 2- Gene flow 3.mutation 4.non-random mating 5. Natural selection. *- Speciation: 1- Different concepts of species. 2- Modes of speciation; allopatric speciation and sympatric speciation ....etc *- Genetic variation (between and within population) *-The genetic basis of traits – quantitative genetic variation and the phenotype via genotype. inheritance of *- Sources of variation (mutation and sexual recombination) *- Extinction.

**GENETICS 8305** **علم الوراثة**

(a) Modern concept of gene, split gene, genetic regulation, genetic code. (b) Sex chromosomes and their evolution, sex determination in Drosophila and man. (c) Mendel's laws of inheritance, recombination, linkage, multiple alleles, genetics of blood groups, pedigree analysis, hereditary diseases in man. (d) Mutations and mutagenesis. (e) Recombinant DNA technology; plasmid, cosmid, artificial chromosomes as vectors, transgenic, DNA cloning and whole animal cloning (principles and methods). (f) Gene regulation and expression in prokaryotes and eukaryotes. (g) Signal molecules, cell death, defects in signaling pathway and consequences. (h) RFLP, RAPD and AFLP and application of RFLP in DNA finger printing, ribosome technologies, human genome project, genomics and protomics. Practical: 1- Develop critical thinking and problem-solving skills. 2-Learn vocabulary and processes so that you are conversant in genetics topics and can communicate with colleagues. 3- Be able to articulate connections between multiple levels

of genetic organization: molecular mechanisms, the expression of DNA at the individual level, and the transmission of that DNA across generations at the individual and population levels

**PHYSIOLOGY II 8306 علم وظائف الأعضاء 2**

UNIT 1: Digestive System: Anatomy and histology of alimentary canal. Digestive glands – histological structures of salivary glands, pancreas, liver. Deglutition. Movements of alimentary canal and their regulations. Composition, functions and regulation of the secretion of salivary, gastric, pancreatic and intestinal juices and bile. Synthesis of Bile acids. Enter hepatic circulation. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. Histological structures of large intestine. Defecation. Feces. UNIT 2: Nerve Physiology: A brief outline of organization and basic functions (sensory, motor and association) of the nervous system (central and peripheral). Central nervous system. The meanings. The blood –brain barrier. CSF: formation, and functions. Structural organization of different parts of brain and spinal cord. The spinal cord, Gross anatomy and sectional anatomy. Reflex action – definition, reflex arc, classification and properties. The brain, major divisions of the brain. Structure, connections and functions of cerebellum. The diencephalon, functions of thalamus and hypothalamus. Midbrain: structure, connections and functions. Structure and functions of pons and medulla oblongata Cerebral cortex: histological structure, localization of functions. UNIT 3: General Endocrinology: Introduction. Compare the similarities between the endocrine and nervous system. An overview of the endocrine system. The structure of hormones. The mechanisms of hormonal action. Classification of endocrine glands and hormones. The control of endocrine activity Hypothalamus as a neuroendocrine organ. Anterior and posterior pituitary –– histological structure of the gland. Chemical nature, mode of action, functions and regulation of secretion of their hormones. Pineal gland – histological structure. Chemical nature, biosynthesis, mode of actions, functions of melatonin. Thyroid and parathyroid glands. Chemical nature, mode of action, functions of the hormones. Thymus gland. Chemical nature, mode of action and functions of thymic hormones. Adrenal glands histological structure of the gland, Adrenal cortex and medulla hormones. Chemical nature, mode of action and functions of adrenal hormones. Endocrine tissue of the reproductive system, chemical nature, mode of action and functions of tests and ovaries hormones.

**PARASITOLOGY 8307 علم الطفيليات العام**

By the end of this lectures the students should have a detailed understanding of the followings: Geographical distribution, morphology, habitat, life cycle, ,pathogenicity ,epidemiology, mode of infection with parasite ,the diagnostic techniques, prevention and

control of parasitic transmission for each parasite. 1.Introduction: Types of parasites: Ectoparasite, Endoparasites, Obligate Parasite, Facultative parasite, Accidental parasite, Erratic parasite. Types of hosts: Definitive host, Intermediate host, Parasitic, obligatory host, Reservoir host, and Accidental host. Symbiotic relationships between two organisms: Parasitismis, Mutualism, Commensalism, The routes of parasitic transmission. Defination of the terms: Zoonosis, Disease, Infestation, Epidemic, Endemic, Pandemic, Incubation period. 2. Amoebic infections: ( *E. histolytica , E. dispar , E. coli, E. hartmanini, E. gingivalis, Endolimax nana, Iodamoeba buetschlii*). 3. Flagellates and Cilliates :( *Giardia lambelia, Trichomonas hominis, T. tenax,Chilomastixmesnili, Dientamoeba fragilis,Trichomonas vaginalis*and *Balantidium coli*).4.Malaria:*Plasmodium malaria*(*P.vivax, P. ovale, P. malariae,* and *P.falciparum.* 5.African South American trypanosomes :*(T. gambiense, T. rhodesiense Trypanosome cruzi). Leishmania*: Visceral (*L. Donovanidonovani, L. dinfantum* and *L. dchagasi).* Cutaneous: (*L.tropica, L. major*) Mucocutaneous Leishmania (*L. Braziliensis* ). Diffuse cutaneous *Leishmania* ( *L. aethiopica* ). 6. Cestodes (*Taaenia solium, T. saginata, Diphyllobothrium latum, Dipylidium caninum, Hymenolepsis nana, H. diminuta, Echinococcus granulosus, E. Multilocularis* 7.Liver flucks :( *Fasciola hepatica, clonorchis sinensis* ),Intestinal flucks: *Fasciolopsis buski, Heterophyes heterophyes* and Pulumonary flucks:(*Paragonimus westermani*). 8. Blood flucks: Schistosomes: (*S. mansoni, S. haematobiu*m, *S. Japanicum*). 9.Nematodes (1) :*Ascaris lumbricoides, Trichurus trichura, Entrobius vermicularis and Trichnella spiralis.* 10.Nematodes (2)(*Strongyloides sterocoralis, , Ancylostoma duodenale, Necator americanus,* Filarial worms: (*Wuchereia bancrofti, Brugimalayi, , Loa loa* and *Onchocercus volvulus* ). Periodicity of blood microfilaria.

**SYSTEMATIC ENTOMOLOGY 8308** **علم تقسيم الحشرات**

Brief history of classification from Aristotle to recent, Methods of classification, economic importance of insect classification, classification ad phylogeny of insects, Broad outlines of insect classification, Taxonomy categories. The international code: Law of priority; Author's name; Ethics in classification. Natural terms of categories, Segregation of species, identification, description, Entomological drafting, types of taxonomic characters, presentation of finding, types of keys. Practical: What immature insects look like, how to rear immature stage, where to collect insects, preservation and display of insects, main characters of the important families of insect orders: A. Exopterygota insects:- Ephemeroptera, Odonata, Plecoptera, Embioptera, Blattaria, Phasmida,Mantodea, Orthoptera, Isoptera (Termites), Dermaptera, Psocoptera, Mallophaa, Siphunculata

(Anoplura), Hemiptera, Homoptera, Thysanoptera. B. Endopterygote insects:- Neuroptera, Coleoptera, Lepidoptera, SiphonapteraDiptera, Hymenoptera, Mecoptera, Trichoptera.

**COMPARATIVE VERTERATE ANATOMY 8309** **علم التشريح المقارن**

A. Introduction: Need for study of comparative anatomy; methods of study, homology and analogy, ontogeny and phylogeny, recapitulation theory. B. Comparative study of various organ systems in different vertebrate groups. 1. Integumentary system: structure of skin and its embryonic derivation; different integumentary structures e.g. hair, scale, hoof, hom, nail, scutes, feathers, glands etc. 2. Digestive system: general structure; mouth and associated structures e.g. oral cavity, tongue, teeth, pharynx, esophagus, stomach, intestine, proctodeal structures, digestive glands. 3. Respiratory system: gills, lungs, swim bladder, its origin and function; accessory respiratory organs. 4. Sketal system: cartilage and ones, membrane and cartilage bone; intramembranous and endochondral ossification, development, eurocranium and splanchnocranium; modification of different cranial elements in different vertebrate groups; vertebral column; sternum and ribs; appendicullar skeleton. 5. Muscular system: Embryonic development; different kinds of muscles; appendicular muscles. 6. Circulatory system: Blood vascular system; structure and modification of heart; aortic arches and their modification; other arteries; major veins and their modification, lymphatic system. 7. Urinogenital system: development of nephrons and their organization into different kinds of kidneys e.g. pronephrons, mesoephrons and metanephrons. Gonads, their development and relationships with kidneys; male and female genital ducts; different kinds of uteri. 8. Nervous system: its differentiation and growth; brain and its parts; cranial nerves; spinal nerves; autonomic nerves; sense organs. Practical: Will consists of work relating to all the above systems with the help of slides, demonstrations, dissections, charts and models etc...

**MARINE FISHERIES 8310** **علم الأسماك البحرية**

Course Objectives: Marine Fisheries is an introductory course geared towards undergraduate students interested in marine science. The aim of this course is to provide students with a broad understanding of fisheries science by focusing on four main components: Fishes, Fisheries, Fisheries Assessment and Fisheries Management. Course Outline: Introduction to the course, Fisheries History. Marine Ecology and production. Fishes species: Life history, growth, reproduction. Population structure. Fishing gears and techniques. Fisheries Assessment. Fishing effects on populations by catch. Fishing effects on habitats. Fisheries managements. Climate change. Marine culture

**ELECTRON MICROSCOPY 8400** **المجهر الالكتروني**

Theory: Electron Microscopy is a comprehensive course on the bare essential of specimen preparation, with the main focus being on microscope operation and the production of excellent micrographs/photographic plates from both the Transmission Electron Microscope (TEM) and the Scanning Electron Microscope (SEM). Both the theory and practice(s) of Electron Microscopy will be covered over the course of the semester during lecture and lab periods. In a nutshell, you will learn about the principles of electron microscopy in lecture and apply them during lab. Course Objectives. By the end of this semester, you should possess the following skills/knowledge: 1. Ability to operate both the TEM and SEM at a level I deem appropriate. 2. Basic knowledge of the design and mechanics of scope operation for both microscopes. 3. Ability to convert raw data collected from scopes (negatives or digital images) into a publishable form via imaging software. 4. Basic knowledge of some of the specimen preparation steps involved in preparing specimens for both the TEM and SEM. We will not have time for you to practice the steps, as it is too time consuming. Most will be by demonstration only. You will be free to prepare specimens for the SEM and TEM if you wish to do so.

**CELL BIOLOGY 8401 بيولوجية الخلية**

(a) Structure and function of cell and its organelles (nucleus, plasma membrane, mitochondria, Golgi bodies, endoplasmic reticulum, ribosomes, and lysosomes), cell division (mitosis and meiosis), mitotic spindle and mitotic apparatus, chromosome movements, chromosome type polytene and lambrush, organization of chromatin, heterochromatin, Cell cycle regulation. (b) Nucleic acid topology, DNA motif, DNA replication, transcription, RNA processing, translation, protein foldings and transport.

**MOLECULAR BIOLOGY 8402 علم البيولوجيا الجزيئية**

Detailed analysis of the biochemical mechanisms that control the maintenance, expression, and evolution of prokaryotic and eukaryotic genomes. Topics covered in lecture and readings of primary literature will include: gene regulation, DNA replication, genetic recombination, RNA processing, and translation. The logic of experimental design and data analysis will be emphasized. Presentations will include lectures, reading assignments and group discussions. Writing assignments, Problem Sets (ungraded) and review sessions contribute to the course content. Graduate students registered for 7.58 are expected to explore the subject in greater depth.

**HISTOCHEMISTRY 8403 كيمياء الانسجة**

1-Introduction and Historical Review 2-Cold Knife and cold Microtome (Cryostat) methods 3-Freezedrying of Biological tissues 4-Freeze- substitution of tissues and sections 5-Chemistry of fixation 6-Histochemistry of some important simple proteins. 7-Nucleic acids

and Nucleoproteins, 8-Carbohydrates and Mucosubstances. 9-Lipids, Lipoproteins and Proteolipids. 10-Hydrolytic enzymes: Phosphatases, Estrases. 11-Oxidative enzymes. 12-Dehydrogenases.

**RADIATION BIOLOGYF 8404** **علم الإشعاع الحيوي**

Course Objectives- To provide a fundamental knowledge of the mechanisms and biological responses of human beings to ionizing and non-ionizing radiations through the study of the effects of radiation on biological molecules, cells, and man including cancer and mutagenesis. The course will develop the ability to make objective decisions regarding the relative risks and benefits of radiation use in a variety of applications.

**EXPERIMENTAL EMBRYOLOGY 8405** **علم الأجنة التجريبي**

1. Introduction into experimental embryology. Questions of developmental biology and significance of their study. Approaches to developmental biology (in vitro, in vivo, in ovo). Morphogenic processes.2. Experimental embryology – methods of study I. Model species. Methods to study embryogenesis (gain-of-function", lost-of-function"). Study of gene expression (in situ hybridization), RNA localization techniques (PCR, microarray). 3. Experimental embryology – methods of study II. Methods to determine the role of genes during development (transgenic cells, transgenic and chimeric mouse, „knockout "experiments, morpholinos). 4. Signaling pathways and intercellular communication during development. Induction and competence. Epithelial-mesenchymal interaction. Paracrine factors during development (FGF, SHH, WNT) and examples of signaling disruptions (f. e: cyclopia, achondroplasia). 5. Developmental genetics in invertebrates (*Drosophila melanogaster*). Drosophila as a model of developmental biology. Specification of body axes in invertebrates (dorsal-ventral, anterior-posterior). Protein gradient and maternal genes. Regulation of segmentation and homeotic selector genes. 6. Developmental genetics in vertebrates. Early embryonic development (fertilization, gastrulation). Spemann´s organizing center and primary embryonic induction. Specification of body axes in vertebrates (dorsal-ventral, anterior-posterior).7. Developmental genetics in vertebrates. Early embryonic development – neurulation, cell migration. Mesoderm formation and somite differentiation. Migration of neural crest cells and following their fate. Differentiation of neural tube and disruptions of their closing.8. Developmental genetics in vertebrates. Late embryonic development - formation of head and jaw. Pharyngeal arches development. Disruption of facial prominences development (cleft palate and lip). 9. Developmental genetics in vertebrates. Late embryonic development – teeth development. Epithelial-mesenchymal induction. Examples of changes in signaling during odontogenesis and their contribution to defects of tooth formation. 10. Developmental genetics in

vertebrates. Late embryonic development – limb formation. Induction of limb buds. Specification of dorsal–ventral, anterior–posterior and proximal–distal limb axes. Molecular models of forelimb and hindlimb formation. Examples of signaling modifications and disruptions of finger formation.11. Developmental genetics in vertebrates. Late embryonic development – heart and vessels development. Hematopoiesis and fate of stem cells. Anomalies of heart development.12. Sex determination. Chromosomal determination (mammals, birds, Drosophila). Environmental determination (reptiles).13. Medical application of developmental biology. Identification of genes contributing to developmental defects (positional gene cloning, candidate gene mapping). Examples of gene mutations and syndromes. OMIM – Online Mendelian Inheritance in Man.14. Future application of developmental biology in biomedical research. Multipotent and pluripotent stem cells and their niche. Regeneration therapy. Developmental cancer and gene therapy.

**COMPARTIE PHYSIOLOGY 8406** **علم وظائف الأعضاء المقارن**

introduction, composition of air, water vapor in air, solubility of gases, respiration in water, gills, countercurrent exchange, boundary layers, respiration in air, mammalian lungs. Air–breathing fish, bird respiration, insect respiration, cyclic respiration, oxygen transport in blood, respiratory pigments, oxygen dissociation curves, facilitated diffusion. Carbon dioxide transport, pumps and channels, water compartments, circulation patterns, cardiac output, blood vessels, physics of pipe flow, blood pressure, capillaries, exercise, invertebrate circulation, clotting. Feeding, food types and mechanisms, hydrothermal springs, digestion, enzymes, wood and cellulose digestion, ruminants, nutrition, vitamins, minerals, trace elements, chemical defense, metabolic rate, energy storage, oxygen. Diving mammals and birds, metabolic rate and body size, size and scaling, energy cost of locomotion, running, swimming and flying, physiological time. Temperature and Q10, high temperature and heat death, low temperature. and freezing, temperature adaptation, acclimation, acclimatization ,body temperature of birds and mammals, heat and heat transfer. Heat balance, temp regulation in the cold, insulation, huddling, heat exchangers, temp regulation in the heat, evaporation, torpor and hibernation, heterotherms, hot fish, hot insects. Aquatic animals, aquatic invertebrates, aquatic vertebrates, amphibians, moist–skinned animals, arthropods, terrestrial vertebrates, marine vertebrates. Marine mammal osmotic regulation, organs of excretion, invertebrate excretion, vertebrate kidneys, fish, amphibian, and reptile excretion, urine concentration, nitrogen excretion. Amoeboid, ciliary, flagellar locomotion, principles of locomotion, muscle structure and function, contractile properties of muscle, fiber types, cardiac muscle, smooth muscle. Rigid skeletons, hydrostatic skeletons, muscular hydrostats, locomotion, buoyancy, reduction of density, gas

floats, fish swim bladders, secretion of gas. Control theory, nerves and nervous systems, nerve cell function, resting potential, action potential, myelination, synapses, synapses continued, PSPs, inhibition, excitation. Vertebrate endocrine systems, transmitters, invertebrate endocrine systems, insect endocrinology, Chemical senses, vibration and sound, light and vision, animal electricity. Transmission and sorting of information, information processing .

**ENDOCRINOLOGY 8407** **علم الغدد الصماء**

1. General Principles of Endocrinology: What are hormones, types of release, homeostasis and feedback, causative vs. permissive, organizational vs. activational . 2. Techniques for Studying Endocrinology; Extirpation/replacement, RIA, etc. 3. General Principles of Endocrinology: Peptide Hormones; Steroids, catecholamine's and prostaglandins Steroids, catecholamine's and prostaglandins. 4. The Hypothalamic-Pituitary System I .Anatomy, Tropic Hormones. 5. The Hypothalamic-Pituitary System II .Tropic hormone regulation. 6. The Hypothalamic-Pituitary System III .Tropic hormone regulation; Vasopressin, Oxytocin, & Melatonin. 7. Thyroid Hormones I .Biochemistry and Mechanisms of Action. 8. Thyroid Hormones II. Biological function. 9. Spermatogenesis, Testicular function, Sex Differentiation. 10. Reproduction II – Females .Ovarian cycles, Pregnancy, Lactation. 11. Reproduction III – Comparative Aspects .Vitellogenesis, Sex determination, Clinical Diseases. 12 .Reproduction IV: Seasonal Breeding .Metabolism I – The Endocrine Pancreas ; Pancreatic Anatomy, Insulin and Glucagon .

**IMMUNOLOGY 8408** **علم المناعة**

Course objective(s):1-Students should gain an understanding of basic aspects of the Structure, and function of immune system.2- Students should describe the applied aspects of immunology such as mechanism, allergy and auto immunity. 3. Students should understand the cellular interaction of immune responses. Description:- 1.Introduction and overview of immune system. 2.Elements of innate and Acquired immunity. 3.Immunogens and antigens. 4. Immunoglobulins: Structure& Function. 5. Immunoglobulins: Isotyps, Allotyps and Idio types. 6.Antibody-antigen interactions. 7.The complement system. 8.Major histocompatibility complex. 9.T-cell receptors 10.Hypersensitivity reactions 11.Autoimmunity.

**TOXICOLOGY 8409** **علم السموم**

This course is prepared to the undergraduate students in Zoology and other related fields. Students should have taken organic chemistry and physiology. 1.Introduction: Definition ,history, and relation to other sciences. 2.Cocept of doses: Definition ,lethal concentration, lethal time, dose-effect relationship. 3.Uptake of toxicants: Oral, Inhalation, skin contact

and other abnormal uptake including different types of injection, absorption of toxicants in the body. 4.Types of toxic action: Acute toxicity, chronic toxicity, some examples of toxic agents such as pesticides, toxic metals, toxic gases. 5.Metabolism and excretion of toxicants: Role of the liver, role of the kidney and other miner routes. 6.Praatictical: students will learn how to calculate the doses and their application in any animal.

**Animal Behavior 8410** **علم سلوك الحيوان**

Behavior is one of the most important and interesting aspects of animal biology. Behaviors permit flexibility that allows animals to respond rapidly environmental changes. This course exposes students to the broad field of animal behavior. Students will come to understand the historical foundations of the field, as well as current theories and evidence for a broad range of behavioral topics. We will also focus on how the science underlying our theoretical understanding of behavior is conducted, and how behavioral hypotheses at all levels of analysis can be tested experimentally. Students also participate in practical exercises to learn some fundamental techniques used to study behavior, and will practice reading and analyzing current scientific literature. Behavioral ecology and the evolution of behaviors as adaptations will be recurring themes interwoven through all topics discussed.

**ANIMAL ECOLOGY 8411** **علم بيئة الحيوان**

Animal adaptations to the environment. Animals have various ways of acquiring energy and nutrients. Animals have various nutritional needs ;Herbivores, Carnivores (birds), Carnivores, Omnivores, etc. Regulation of internal conditions involves homeostasis and feedback. Animals have different methods of maintaining their body temperatures; Poikilotherms depend on environmental temperatures; Homeotherms escape the thermal restraints of the environment; Maintenance of water balance. Biological clocks influence animal activity, Population ecology; Properties of populations; Population growth, life tables , metapopulation, species interactions, intraspecific; population regulation. Community ecology: Community structure, factors influencing the structure of community, community , community dynamics; Ecosystem ecology: Ecosystem types; Ecosystem energetics, decomposirion and nutrient cycling.

**APPLIED ENTOMOLOGY 8412** **علم الحشرات التطبيقي**

Introduction; History of Insect Control; Failure of insect control; Patterns of plant and animal protection; Agroeco system; Cost/benefit and Benefit/risk in pest control. Ecological, Economical and Social consideration in Pest control. Post Life Table end I Host Life stages. Plant resistance in insect control. History and examples, components of resistance, nonpreference and preference, Antibiosis, Tolerance, Limitations. Biological control: Advantages, Ecological background, Kinds, Parasites, Predators, competition, Limitations.

Microbial control; Insect pathology, Infections of insects, Protozoa, Fungi Nematodes, Rickettsia. Chemical control: History, Classification, Advantages, Limitations, Selectivity. Genetic and behavioural control: Sterilization, History, Application, Limitnitations, Attractants.; Feeding, mating and oviposition, Utilization in control, Repellents, uses and limitations. Culture methods: Sanitation, Tillage, Rotation, Other practices Physical and Mechanical control: Temperature, Heat, cold, Humidity, Light Regulatory, control, eradication. Containment, Suppression, Monitoring.

**SPECIAL CHORDATES 8413** **علم الحبليات الخاصة**

1-Introduction. 2-Classification of Fishes. 3-Comparative study of integumentary system: modification of exoskeletal structures, scales, coloration, luminous organs; Poison glands electric organs etc. 4-Food and feeding habits. 5-Respiratory system, gills, air bladder and its modification and functions; accessory breathing organs. 6-Blood vascular System . 7-Excretion and osrmoregulation. 8-Nervous system and sense organs. 9-Reproductive organs. 10-Eggs, breading habits and parental care . 11-Migration in fishes. 12-Fishes and man.

**SPECIAL TOPICS 8414** **مواضيع خاصة**

The several framework is similar to that of independent studies (8419) but differ in the following: 1-Subject chosen must be within the specialization of member of staff allocated by department to supervise the student 2-Evaluation must include an oral and written examination as well as an oral presentation. The department reserves the right to make changes to this syllabus as and when it deems necessary. This course may be given by several staff members in the form of lectures covering various topics and including details not covered in any other departmental course. In this case, student is evaluated through a written examination.

**SEMINAR 8415** **ندوة بحث**

This is to be attempted by students in their final semester, i.e. would be graduates. The student is free to choose a topic within any one of the fields he/she received instruction and student will be examined on the topic selected at an oral defense before a committee of the Department and is expected to submit a bound report covering all relevant details regarding subject of choice. Emphasis is made on the acquisition of up-to-date scientific information be it from library. References or through the consultation of various membranes of staff. Subject matter is not to be repeated and students must consult the department check list of past seminar titles before registering their own evaluation is instant following an oral presentation given to selected staff membranes. proportion of the marks

is allocated to: i- Report presentation ,layout, quotation of References etc. ii- Attendance of seminars of fellow students. iii- The instigation of relevant and stimulating discussion.

**RESEARCH PROJECT 8416** **مشروع بحث**

In the graduating semester student must carry out a research project under supervision of a member of the Department. A report on the project must e submitted to the Department and each student will be examined on the project at an oral defense before a committee of the Department.

**MEDICAL ENTOMOLOGY 8417** **علم الحشرات الطبية**

Course Description: Medical Entomology covers direct injuries caused by arthropods such as phobias, annoyance, allergies, toxins, venoms and myiasis, arthropod transmission of vertebrate parasites, epidemiology of arthropod borne diseases. Students study transmission of diseases, methods of surveillance for diseases, management by vector control and other methods of prevention of arthropod borne diseases. Course Objective(s): By the end of this lectures the students should have a detailed understanding of the followings: Geographical distribution, morphology, habitat, important characteristics for identification, life cycle, biology and behavior of the arthropods of public health importance , roles in disease transmission, the role of insects as vectors of diseases and their effects on human populations. and apply prevention and control methods for arthropod vectors. Course Outline: 1. Introduction: What is the role of arthropods in the transmission of disease, what makes a good vector, what agents cause disease, clinical signs of disease, and the physical and psychological impact of vector borne disease. 2. Mosquitoes: Culicidae: History of Mosquito Borne Diseases , Arboviruses, Yellow Fever, Dengue, Malaria and Filariasis. 3. Black Flies: Onchocerciasis, Diseases leading causes of blindness and disfigurement. 4. Sand Flies :Diseases leading causes of Leishmaniasis. 5. TsetseFly-AfricanTrypanosomiasis. 6. Horse Flies and Deer Flies—Equine Infectious Anemia, *Loa Loa* 7. Biting Gnats—Bluetongue, VS and African Horse Sickness: the changing face of the *Culicoides* vectors 8.Muscoid Flies—Role of flies in food borne illnesses and disease transmission. 9.Myiasis -infection by parasitic fly larvae that feed on their host living/dead tissue. Botflies, Sheep Ked, 10. Fleas—Plague, the Black Death is still here 11. Fleas Chigoe fleas, Murine typhus: fleas, rodents and *Rickettsia* 12. Lice—Cooties to Crabs: Human lice, Epidemic Typhus, *Rickettsia*. 13. Bugs-Bedbugs The triatomines of Latin America, Chagas Disease allergies, bite reaction 14. Ticks and Mites: Biology, Tick borne disease, Lyme Disease and other Borrelia, Tick borne disease, Rickettsial infections, Rocky Mt. Spotted Fever,*Babesia,* Biology, Mites and Dermatitis,

Scrub Typhus and Rickettsial Pox, scabies, Demodex – hair follicle mites Blattaria, skin rashes, congestion of nasal passages and asthma.

**INSCT PHYSIOLOGY 8418 علم وظائف الحشرات**

The integument, composition and fine structure. The growth molting and metamorphosis. The alimentary canal and the digestion. The metabolism and nutrition. Respiration, the Tracheae and tracheoles. The circulatory system and the mechanism of circulation. The excretory system and excretion. Reproductive system and reproduction. The nervous system and the endocrine system. The muscular movement.

**INDEPENDENT STUDIES 8419 دراسة مستقلة**

Student is expected to submit a detailed report on a subject chosen in consolation with the supervising instructor. The report is evaluated following an oral discussion. Alternatively, the student may be asked to deliver a presentation of his/her work.

**DESERT ECOLOGY 8420 البيئة الصحراوية**

Biology and ecology of familiar species to show strategies for survival deserts:- 1. The date Palm and legume 2. The desert Locust and horned viper. 3. The Ostrich and Camels. 4. Man and his domestic animals. The Environment-physical and climatic. 5. Classification of deserts on physical and climatic criteria. Differences between hot& cold deserts with ecological importance. 6. Early history of recent hot deserts& survey of main deserts. Desert physiology; erosion patterns, sand formations etc. The Sahara. 7. Geomorphology of the Sahara, Recent climate and climatic variations ,World climate changes &recent droughts. 8. Precipitation &condensation, Water available for life humidity ,microhabitats, metabolic water, Salinity and desert water, Fertility of desert soils, Sand crusts for burrows. Plant life and Productivity. 9. Form of roots& shoots, Transpiration rates, life histories of annuls Germination ; pollination; seed dispersal. 10. Biomass of plants plant products, biomass of animals in relation to plants. Desert Herbivores. 11. Insect herbivores, life histories, physiology; diapese& special adaptations. Block color of many desert animals, influence of dominant species. Locust, Ants& Termites. 12. Reptiles,Birds,& Mammals; also Mollusks. Life- histories etc. Physiology & special adaptations; Jerboa; protective, behavioral adaptations. Desert Carnivores: 13. Ecological relationship of Herbivores & Carnivores. Arthropoda Carnivores. Life histories, Scorpion, Ant lion. 14. Vertebrate Carnivores. Examples, Longevity, Physiology. Venomous animals-role in desert ecology. Other Desert Niches & Summary. 15. Coprophagus & Carrion feeders, Beetles, culture &hyena. Oases, frees hater fauna: Amphibians and fishes, Food chains and food webs. 16. Utility of all organic matter, pyramid of numbers and biomass, Limiting factors in total productivity, Energy considerations. Adaptations: Desert life. 17.

preadatations. Species typical of desert comparisons with related species, Stability of desert biota, Domestic animals. 18. Man's capacity to modify the environment. Ecological considerations for arresting desertification. Strategies for increasing the productivity of deserts. Past &future life-styles of man in desert.

**CELL PHYSIOLOGY 8421 علم وظائف أعضاء الخلية**

COURSE OBJECTIVES: 1. To study mammalian cell functions and relate them to cell structure. 2. To gain an understanding of modern experimental techniques used in cellular physiological research. 3. To gain critical thinking and integrative writing skills required for cellular and physiological research. COURSE OUTLINE: 1. Overview and review of basic cell structure function and cell diversity in mammals 2. Membrane voltage-gated ion channels: molecular structure, biophysics and regulation of physiological process 3. Transport across biological membranes: molecular structures, biophysics and regulation of physiological process . 4. Cell-to-cell signaling: hormones, receptors and intracellular messengers 5. Protein synthesis, vesicular trafficking, endocytosis and exocytosis 7. Neurons, synaptic transmission and ligand-gated ion channels 8. Extracellular matrix and cell-cell interactions 9. Genetic approaches to study the physiology of mammalian cell 10. Aspects of experimental techniques in cell biology and cell physiology.

**NUTRITION AND METABOLISM 8422 الايض والتغذية**

This course will use basic science concepts to explain nutrient function, metabolism and interaction in humans. This course will cover the metabolic and physiological functions of nutrients at the molecular, cellular, tissue, organ and system level, integrating the effects of nutritional status in health and disease. An emphasis will be made on current research as it applied to content covered in the class. We will have a short online quiz over material in the book prior to the beginning of each lecture section. Presentations will be given by groups of students on a topic not covered in class (every weak) and attendance material will be filled out each week. Recent papers pertaining to a topic related to lectures will be analyzed and three exams will be given. Final grade determination is based on the scale provided below.

**PROTOZOOLOGY 8423 علم الأوليات الطفيلية**

Course Objective(s): By the end of this, lectures the students should have a detailed understanding of the followings: Geographical distribution, morphology, habitate, life cycle, pathogenicity, epidemiology, mode of infection with protozoan parasites, the diagnostic techniques, prevention and control of parasitic transmission for each parasite. 1. Free living Amoebae Naegleria and acanthamoeba cause amoebic encephalitis. 2. Cryptosporidium: Many species of *Cryptosporidium* exist that infect humans and a wide

range of animals. *Cryptosporidium parvum* and *Cryptosporidium hominis* (formerly known as *C. parvum* anthroponotic genotype or genotype 1) are the most prevalent species causing disease in humans, infections by *C. felis*, *C. meleagridis*, *C. canis*, and *C. muris*have also been reported. 4. *Toxoplasma gondii* that cause encephalitis in AIDS patients and affects severely the pregnant women. 5. *Isospora belli that cause severe diarrheal disease*. *6. Eimeria: E. ovina*, *E.falciformis*, *E .intestinalis*,*E .gallinarium, E .mitis.* 7. *Hepatozoon 8. Sarcocystis: S .ovifelis, S.bovicanis, S.*equiea 9. *Ichthyophthiriusmultifilis.* 10. *Pneumocystis carinii*that causes severe pneumonia and respiratory failure in immunocompromised patients. 11. Microsporidia: Morphology and Life CycleMicrosporidia Infections of Humans, 12. Trypanosomes :T.rangeli, *T.lewisi .T. evansi* 13. Myxozoa: *Myxozoacerebralis,*

**HELMINTHOLOGY 8424 علم الديدان الطفيلية**

Introduction to heilminthology. Helminthes parasites as biological models. The study of morphology, reproduction taxonomy, patterns and ecology of the life cycles; location and entry of hosts; growth and establishment of parasites in the trematodes, cestodes, acanthocephalans and nematodes. Recombinant DNA and Applications. The structure and function of Eukaryotic chromosomes. Control of Gene expression: Mechanisms of genetic change I, gene mutation, IIrecombination, III transposable Genetic elements. The extranuclear Genome. Developmental Genetics: Cell fate and pattern formation. Gene regulation and differentiation.

**MARINE ECOLOGY 8425 علم بيئة البحار**

Introduction: Thoughts on the rate of the seas in the origin and early evolution of the life. The progression of life through the ages . Some parameters of the environment: Temperature, Composition of sea water Specific gravity and pressure, Viscosit'yt, Illumination, currents, Tides and waves. Organic production in the sea: the organic food cycle, some –factors regulating production, Ocean seasons Geographical difference of fertility Sea bottoms. Sea Shore: the evolution of coast line, Some problems of shore life, Food sources, Zonation, fitting, the shore environment, Rooky snores, Sand shores, Muddy shores, Estuaries. Sea fisheries: Fishing methods, The biology of some food fishes, The over fishing problem, Fishery research .The regulation of fisheries The sea in relation to human food supplies.

**MOLECULAR GENETICS 8426 علم الوراثة الجزئي**

To understand the molecular basis for transcription, translation, replication, and gene regulation and other topics in molecular genetics for both prokaryotes and eukaryotes. To understand the underlying theoretical principles of the scientific methods and approaches

of molecular genetics. To be able to critically interpret experimental designs related to molecular genetics. To acquire an appreciation for the impact of molecular genetics (particularly of human) in physiology, evolution, and disease.

**VIROLOGY 8428 مدخل لعلم الفيروسات الحيوانية**

Definition of virus & its characteristics. Symptoms of virus-infected plants. Transmission. Testing for virus using indicator plants. Morphology and ultra-structure. Methods of isolation & purification of viruses.

**AQUATIC INSECTS 8429 علم الحشرات المائية**

OBJECTIVES: 1. Demonstrate a knowledge of the taxonomy of aquatic insects (adults and immature): a. Identify basic morphological structures common to all aquatic insects. b. Identify all aquatic insects to order on sight. c. Identify common aquatic insects to family on sight. d. Identify most immature aquatic insects to genus with taxonomic keys and microscope. 2. Describe selected aspects of the biology of aquatic insects: a. behavior. b. habitat preferences. c. feeding habits. d. life history. e. metamorphosis. f. physiology. g. reproduction. h. adaptations to freshwater environment. i. functions in aquatic ecosystems. 3. Demonstrate current methods used in aquatic entomology: a. collecting. b. preserving. c. preparing specimens for study.

**Marine pollution 8430 علم التلوث البحري**

1- An Introduction to Marine Pollution. 2. Nutrients and oxygen demanding wastes 3. Oil and hydrocarbons. 4. Antifoul ants past and present. 5. Metals and mining. 6. Compartments, distribution processes and community response – case studies on sediments and dredging. 7. Plastic wastes – the floaters. 8. Radioactivity. 9. Water and sediment quality monitoring risk assessment and compliance testing. Risk assessment tools: Ecotoxicology, multiple lines of evidence, community response. 10. Understanding management actions and legislation that can reduce and minimize pollution.

**اسم المقرر: علم البرمائيات رقم المقرر: 8431**

1 – نبذة تاريخية عن البرمائيات 2 – تصنيف البرمائيات وصفاتها وخصائصها والتركيب الداخلي والشكل الخارجي 3 – علم البرمائيات وعلاقتها بالتطور والانقراض 4 – الأنواع الموجودة في ليبيا والحفريات منها 5 – العلاقة بين البرمائيات (الفريسة والافتراس) 6 – دراسة حقلية وطرق صيدها وتربيتها للاستفادة منها 7 – دراسة السلوك الحيواني للبرمائيات (الهجرة – التكاثر – الاغتذاء – الاقتتال ...) 8 – دراسة تربية البرمائيات في التجارب حسب النوع والعمر 9 – الاهمية ودورها في الحياة (اقتصادية – طبية – اجتماعية – بيئية ....)

**اسم المقرر: علم الزواحف رقم المقرر: 8434**

1 – نبذة تاريخية عن الزواحف 2 – تصنيف الزواحف و صفاتها و خصائصها و التركيب الداخلي و الشكل الخارجي 3 – علم الزواحف و علاقتها بالتطور و الانقراض 4 – الأنواع الموجودة في ليبيا و الحفريات منها 5 – العلاقة بين الزواحف ( الفريسة و الافتراس ) 6 – دراسة حقلية و طرق صيدها و تربيتها للاستفادة منها 7 – دراسة السلوك الحيواني للزواحف ( الهجرة – التكاثر – الاغتذاء – الاقتتال ... ) 8 – دراسة تربية الزواحف في التجارب حسب النوع و العمر 9 – الاهمية و دورها في الحياة ( اقتصادية – طبية – اجتماعية – بيئية .... )

**اسم المقرر: علم الطيور رقم المقرر: 8437**

1 – نبذة تاريخية عن الطيور 2 – تصنيف الطيور وصفاتها وخصائصها والتركيب الداخلي والشكل الخارجي 3 – علم الطيور وعلاقتها بالتطور والانقراض 4 – الأنواع الموجودة في ليبيا والحفريات منها 5 – العلاقة بين الطيور (الفريسة و الافتراس) 6 – دراسة حقلية وطرق صيدها وتربيتها للاستفادة منها 7 – دراسة السلوك الحيواني للطيور (الهجرة – التكاثر – الاغتذاء – الاقتتال) 8 – دراسة تربية الطيور في التجارب حسب النوع والعمر 9 – الاهمية ودورها في الحياة (اقتصادية – طبية – اجتماعية – بيئية ...) 10 – أنواع الريش 11 – دورة حياة الطائر 12 – أنواع البيض وتركيبه

**اسم المقرر: علم الثدييات البرية رقم المقرر: 8440**

1 – نبذة تاريخية عن الثدييات البرية 2 – تصنيف الثدييات البرية و صفاتها و خصائصها و التركيب الداخلي و الشكل الخارجي 3 – علم الثدييات البرية و علاقتها بالتطور و الانقراض 4 – الأنواع الموجودة في ليبيا و الحفريات منها 5 – العلاقة بين الثدييات البرية ( الفريسة و الافتراس ) 6 – دراسة حقلية و طرق صيدها و تربيتها للاستفادة منها 7 – دراسة السلوك الحيواني الثدييات البرية ( الهجرة – التكاثر – الاغتذاء – الاقتتال ... ) 8 – دراسة تربية الثدييات البرية في التجارب حسب النوع و العمر 9 – الاهمية و دورها في الحياة ( اقتصادية – طبية – اجتماعية – بيئية .... )

**ZOOLOGY FOR GEOLOGY 8601 علم الحيوان العام لطلبة علوم الأرض**

General Introduction: Classification of Animal kingdom, Concepts of species and genera, scientific names of species and genera Categories of higher ranks than genera. Definition of fossils, diversity of fossils and value of fossils. Phylum- Protozoa: Basic characters and classification, Foraminifera and Radiolaria, ecology and Geological distribution. Sponges and sponge-like fossils General characters, types of sponges, fossil record. Coelenterates: General characters and classification , coral and its formation. Bryozoa: General characters and distribution. Brachiopoda : General characters and distribution. Molluscas .General characters and classification, Chiton, Scaphopoda, Gastropoda, Cephalopoda and Pelecypoda. Geologic work, of worm- like annelids and other worms. Afthropods: Skeletalfeaturessegmntation of body and appendages Trrilobita, Ostracoda and Chelloorata. Echinodermata General characters and classification Asteroidea Echinoidea, Holothuiodea, Crinoidea. Classification of Phylum Vertebrate. General survey with special

emphasis on Fossil and extinct forms. Ecological adaptation shown by animals in different habitats.

**8602 FISH PARASITES 8602 طفيليات واسماك**

Introduction to fish parasites. Definition and classification of fish's .Anatomy of fish .Clinical Diagnosis of fish parasites. Classification of fish parasites. Fishes diseases caused by Protozoan. External protozoan infections:- Ichthyphthiriasis, Trichodmiossis, Cryptocaryonosis, Ichtyopodiosis. Internal protozoan infections:- A-Blood protozoan infections: Cryptobiosis. Trypanosomiosis. B- Intestinal protozoan infections: Hexamitiosis. Whirling disease. Fish diseases caused by helminthes:- 1- Pathogenic Trematodes of fishes, Monogenea infestation of fishes,Digenea infestation of fishes. 2- Pathogenic Cestodes of fishes. 3- Pathogenic Nematodes of fishes. 4- Pathogenic Acanthocephala of fishes. Crustacean parasitic infections of fishes: Ergasilosis. Lerniosis ,Argulosis. Other types of fish parasites.,Economic consideration. Practical Aspect: Clinical Laboratory Parasitic Examination in fish: Skin and external examination. Gill & Blood examination, Examination of the internal organs of fish for parasites.

**AQUACULTURE 8603 مزارع اسماك**

Course Objectives: The purpose of this course is to understanding the scientific approach to aquatic culture. The aim is to learn which are the different techniques applied for the commercial culture of various species of fishes, crustaceans and mollusks. Course Outline. History of aquaculture. Site selection for aquaculture. Monitoring and adjusting water quality in fish culture operation. Use of environmental and hormonal manipulation to spawn finfish and shellfish. Incubate, hatch and maintain cultured aquatic organisms. Seaweeds culture. Live food: Microalgae. Rotifers, Artemia. Mollusks: Bivalves and Gastropods. Freshwater fishes. Marine fishes. Crustaceans. Harvest and prepare fish for marketing.

**FISH NUTRITION 8604 تغذية اسماك**

Course Objectives: This course is designed to provide and understanding of nutrient requirements and feed practices for finfish. The course will also provide the student with a broad overview of the state-of-the-art on nutrition and feeding of fish. The course will help students develop the skills to be able to continuously improve their understanding of nutrition and to be able to integrate information from various sources to develop various tools. Course Outline: History of Fish Nutrition. Introduction to Fish Nutrition Studies. Feeding Habits and Adaptations. Nutrient Requirements. Vitamins and Minerals in fish Nutrition. Fats and Proteins in fish nutrition. Diet Formulation. Larval Feeds. Food Requirements. Feeding Practices. Natural Foods in Extensive Culture. Growth and Feeding. Current Developments

**PRACTICAL SKILLS IN BIOLOGY SCIENCES 8605 المهارات العلمية لعلوم الحياة**

This course aims to provide guidance and support over the broad range of undergraduate courses, including laboratory class's project work. Lectures seminars and examinations. Study and examination skills, information technology and library resources. Communicating information, health and safety. Fundamental laboratory techniques. The scientific approach obtaining specimens, Identifying organisms, Manipulation specimens, advanced laboratory techniques, Analysis and presentation of data

**THE ESSENTIAL TECHNIQUES IN MOLECULAR BIOLOGY 8606 اساسيات التقنية الجزئية**

1- hybridization.Extraction of nucleic acid from different tissues. 2-how, we can determine the size of fragment. 3- Cloning, Sticky, blunt ends. 4- Recombinant DNA in different vector. 5- Plasmids & viruses DNA as a tool for ligation. 6- Competent cells (E. Coli). 7- Transformation (E. Coli). 8- Large & small scale of amplification by using bacteria. 9- Purification of nucleic acid. 10- Sequencing technique. 11- Preparation of different. 12- Preparation of different probe (by using different techniques as isotopes). 13- PCR techniques. 14- Preparation of gone Library. 15- Screening Library. 16- Using the restrictim enzymes. 17- Mapping the genes. 18- the 5'end. 19- Technique insitu