



Department of

Biology

College of Education

Salahaddin University – Erbil

Subject: Advanced Insect Structure and Classification

Course Book: MSc Students

Lecturer's name: Banaz Sdiq Abdulla

Academic Year: 2023 – 2024

### Course Book

1. Course name	Insect structure and Classification
2. Lecturer in charge	Lecturer Asst. Prof Dr. Banaz S. Abdulla
3. Department/ College	Biology, Education

**4. Contact**

**e-mail:**

1. [banaz.abdulla@su.edu.krd](mailto:banaz.abdulla@su.edu.krd)
2. Tel:

**Course Objective:**

Understand morphology of the insects and observe external features of insects, study the head, mouthparts, thorax, leg, wing, abdomen, digestive system and reproductive system of insects by dissection and observation. Study the comparative external and internal anatomy of insects; to familiarize with terminology in the field of insect morphology; to provide an understanding of the functional relationships of the structures, organs and systems, and evolutionary theory; discussing both external and internal morphology and remembering that the terms anatomy and morphology are not synonymous. Discuss general principles of classification, systematics, Taxonomy, nomenclature, use of identification tools, biology and evolutionary history of hexapods. competing classifications exist in taxonomy, and how classifications reflect patterns of evolutionary change and diversification. understanding of insect diversity and the practice of classifying organisms. Understand taxonomic characters of insects, ability to identify insect families from each order of the class Insecta Identification of different insects of some important families, understand the advantage and disadvantage of insects to man and their role in the environment.

### **Student's obligation**

The role of students and their obligations throughout the academic Course include:

1. Midterm exam 20%
2. Review Article 10%
3. Quiz 10%
4. Seminar and Presentation 10%
5. Final Exam 50%

### **Course Reading List and References:**

#### **▪ Key references:**

- 1- David, B. V. and Ananthkrishnan, T. N. (2004). General and Applied Entomology. 2nd ed. Tata McGraw-hill Publishing Co. Ltd. New Delhi. India. 1184 p.

## Ministry of Higher Education and Scientific research

2- Elzinga, Richard J. (1997). Fundamentals of Entomology. 4th ed. New Jersey, Prentice-Hall, Inc. 475 pp.

4-Ickman,C.p.;Roberts,L.S.;Larson,A.;l'Anson,H.andEisenhour,D.(2006) Integrated principles of Zoology (chapter20).thirteenth edition. McGraw-Hill Higher education.

5-Imms,A. D. (1970)A general Textbook of Entomology. Ninth edition, London: Methuen & Co LTD.886P.

6 Imes, Rick. (2000). Beginner's guide to Entomology. London. Chancellor Press, 160 pp.

7- Resh, Vincent H. &Cardé, Ring T. (2003). Encyclopedia of Insects. USA. Academic Press, Elsevier Science, 1266 pp.

8- Konstantinov, A.; Tishechkin, A. and Penev, L. (2005). Contributions to Systematics and Biology of Beetles. Papers Celebrating the 80th Birthday of Igor KonstantinovichLopatin .405pp.

9- Gorb, S. (2002). Attachment Devices of Insect Cuticle. New York, Boston, Dordrecht, London, Moscow. 322pp.

10-Gibb, T.J. and Oseto, C., 2019. Insect collection and identification: techniques for the field and laboratory. Academic Press.

11-Foottit, R.G. and Adler, P.H. eds., 2009. Insect biodiversity: science and society. John Wiley & Sons.

### ▪ Useful references:

1- Chapman, R. F. (2013). The Insects Structure and Function, fifth edition Cambridge University Press 961pp.

2-Chown, S. L. and Nicolson, S. W. (2004). Insect Physiological Ecology Mechanisms and Patterns. Oxford University Press. 254pp.

3-Gillott, C. (2005). Entomology. Third edition. Springer, Netherland. 834PP.

4-Gullan, P. J. and Cranston, P.S. (2005). The Insects An Outline of Entomology. Third edition. Wiley Black well. 529pp.

### The Topics

In this section the lecturer shall write titles of all topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture

### Lecturer's name

Lecturer's name

**Asst. Prof Dr.**

**BanazS. Abdulla**

Time: **(3 hours)**

Date:

**Insect Integument and Molting**

**The Molting processes**

Lecturer's name

**Asst. Prof Dr.  
Banaz S. Abdulla**

Time: **(3hrs.)**

Date:

**The Insect Head and The Head Appendages**

**Structure of Head**

Types of head. (a) Hypognathous  
(b) Prognathous (c) Opisthognathous

Functions of Head

Antennae

Structure of antennae

Function of antennae

Different types of antennae

Lecturer's name

**Asst. Prof. Dr.  
Banaz S. Abdulla**

Time: **(3hrs.)**

Date:

**Insect Mouth parts.**

Mandibulate (chewing) mouthparts

Haustellate or Suctorial mouthparts

Typical chewing type of Mouth Parts

Mouthparts modification

Lecturer's name

**Asst. Prof. Dr.  
Banaz S. Abdulla**

Time: **(3 hrs.)**

Date:

**Thoracic Morphology**

**Comparative Thoracic Morphology and Locomotion**

Thoracic nota

Thoracic sterna

Thoracic pleura

**Legs**

Structure of Leg

Legs Modification

**Wings**

Wing Structure and Flight

Lecturer's name

**Asst. Prof. Dr.  
Banaz S. Abdulla**

Time: **(3 hrs.)**

Date:

Wing Area

Wing venation

Different types of wings

Wing coupling apparatus.

Different types of wings coupling mechanisms

**The abdomen:**

Structure of Abdominal segments.

Epimorphic development

Anamorphic development

Abdominal Appendages

Abdominal appendages of primitive hexapoda.

Abdominal appendage in Collembola

Lecturer's name

**Asst. Prof. Dr.**

**Banaz S. Abdulla**

Time: (3 hrs.)

Date:

**Anal Cerci**

Different types of cerci

**Insect digestive system (Alimentary canal):**

Alimentary canal Structure:

1) Foregut

2) Midgut

3. Hindgut

Salivary glands

Glands related to digestive system

Modification of digestive system:

Filter chamber:

Process of digestion

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: (3hrs.)

Date:

**Nervous system:**

Structure of a neuron

Classification of neurons

I. Based on their structure

1. Unipolar 2. Biopolar 3. Multipolar

II. Based on function: 3 kinds of neurons.

1. Sensory / afferent

2. Motor / efferent neurons

3. Association / internuntial neurons

**Central nervous system** (brain, subesophagealganglion, ventral nerve cord)

**Visceral or sympathetic nervous system:**

**Peripheral nervous system:**

**Endocrine system**

2. Endocrine organs are of two types.

a) Neuro-secretory cells in the central nervous system

b) specialized endocrine glands such as

i) Corpora cardiaca

ii) Corpora allata

iii) Prothoracic glands

**The sense organs**

-the sound producing organs

-photoreceptor organs

-ocelli -Compound eyes

-formation of image

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(3hrs.)**

Date:

**Excretory system and Circulatory system**

Excretory system:

Malpighian tubules

Functions of Malpighian tubules:

**Circulatory system:**

Structure of Circulatory system

Process of blood circulation

Blood cells:

Different types of hemocytes.

Functions of blood:

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(3hrs.)**

Date:

**Respiratory system:**

Respiration

Trachea

Tracheoles

Spiracles

Taenidia

Tracheal trunks

The tracheal air sac

Classification of tracheal system based on number and arrangement of functional spiracles

Other types of respiration

Cutaneous respiration

Tracheal gills

Spiracular gills

Blood gills

Rectal gills

Plastron respiration

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(3hrs.)**

Date:

**Reproductive system**

Reproduction in insects

Male reproductive system:

Female reproductive system:

Types of ovarioles : Panoistic and Meriostic

**Egg structure.**

Types of Reproduction.

1. Oviparity
2. Viviparity
3. Parthenogenesis
4. Paedogenesis (or) Neoteny
5. Polyembryony:
6. Hermaphroditism
7. Castration
8. Alternation of generation

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(3hrs.)**

Date:



**Insect development**

- embryonic development
- hatching
- insect eggs, and structure of egg
- Different types of egg
- postembryonic development
- larvae and nymphs

Differences between larva and nymph

- type of larvae
- type of pupae
- The metamorphosis
- type of metamorphosis

1. A metamorphosis, 2. Gradual Metamorphosis
3. Incomplete metamorphosis, 4. Complete metamorphosis, 5. Hyper metamorphosis

Diapause is of two types:

- 1- Obligatory diapause
- 2- Facultative diapause

Aestivation and hibernation

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time:(3 hrs.)

Date:

**Insect classification:**

- Historical basis of Insect classification, nomenclature
- Imms classification and Modern classification
- Components of Insect Classification
- Taxonomy and Systematics
- Concept of Phylogeny and Classification
- Phylogenetic Framework and Divergence Patterns Of Evolutionary History
- Phylogeny of Arthropoda and Hexapoda,
- Phylogenetic Relationship of Major Insect Groups
- Molecular Tools and their Impact on Phylogenetic Studies
- Molecular markers for Insect Identification and phylogenetic analysis.

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: (3 hrs.)

Date:

**Class: Insecta**

Classification of insects based on wing

**Subclass: Apterygota**

**Order: Protura**

General Characters of Order: Protura

Taxonomic characters of Order: Protura

Classification of Order: Protura

**Order: Diplura**

General Characters of Order: Diplura

Taxonomic characters of Order: Diplura

Classification of Order: Diplura

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: (3 hrs.)

Date:

**Order: Thysanura**

General Characters of Order: Thysanura

Taxonomic characters of Order: Thysanura

Classification of Order: Thysanura

**Order: Collembola**

General Characters of Order: Collembola

Taxonomic characters of Order: Collembola

Classification of Order: Collembola

**Class: Insecta**

Classification of insects based on wing

**Subclass: Pterygota**

**Division: Exopterygota**

**Order: Ephemeroptera**

General Characters of Order: **Ephemeroptera**

Taxonomic characters of Order: **Ephemeroptera**

Classification of Order: **Ephemeroptera**

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: (3 hrs.)

Date:

**Order: Odonata**

General Characters of Order: **Odonata**

Taxonomic characters of Order: **Odonata**

Classification of Order: **Odonata**

**Order: Orthoptera**

General Characters of Order: **Orthoptera**

Taxonomic characters of Order: **Orthoptera**

Classification of Order: **Orthoptera**

**Order: Dictyoptera**

General Characters of Order: **Dictyoptera**

Taxonomic characters of Order: **Dictyoptera**

Classification of Order: **Dictyoptera**

**Order: Dermaptera**

General Characters of Order: **Dermaptera**

Taxonomic characters of Order: **Dermaptera**

Classification of Order: **Dermaptera**

**Order: Isoptera**

General Characters of Order: **Isoptera**

Taxonomic characters of Order: **Isoptera**

Classification of Order: **Isoptera**

**Order: Mallophaga**

General Characters of Order: **Mallophaga**

Taxonomic characters of Order: **Mallophaga**

Classification of Order: **Mallophaga**

**Order: Siphunculata**

General Characters of Order: **Siphunculata**

Taxonomic characters of Order: **Siphunculata**

Classification of Order: **Siphunculata**

**Order: Hemiptera**

General Characters of Order: **Hemiptera**

Taxonomic characters of Order: **Hemiptera**

Classification of Order: **Hemiptera**

**Order: Thysanoptera**

General Characters of Order: **Thysanoptera**

Taxonomic characters of Order: **Thysanoptera**

Classification of Order: **Thysanoptera**

**Class: Insecta**

**Subclass: Pterygota**

**Division: Endopterygota**

**Order: Neuroptera**

General Characters of Order: **Neuroptera**

Taxonomic characters of Order: **Neuroptera**

Classification of Order: **Neuroptera**

**Order: Hymenoptera**

General Characters of Order: **Hymenoptera**

Taxonomic characters of Order: **Hymenoptera**

Classification of Order: **Hymenoptera**

**Order: Lepidoptera**

General Characters of Order: **Lepidoptera**

Taxonomic characters of Order: **Lepidoptera**

Classification of Order: **Lepidoptera**

**Order: Trichoptera**

General Characters of Order: **Trichoptera**

Taxonomic characters of Order: **Trichoptera**

Classification of Order: **Trichoptera**

**Order: Diptera**

General Characters of Order: **Diptera**

Taxonomic characters of Order: **Diptera**

Classification of Order: **Diptera**

**Order: Coleoptera**

General Characters of Order: **Coleoptera**

Taxonomic characters of Order: **Coleoptera**

Classification of Order: **Coleoptera**

**Order: Neuroptera**

General Characters of Order: **Neuroptera**

Taxonomic characters of Order: **Neuroptera**

Classification of Order: **Neuroptera**

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: (3 hrs.)

Date:

