



Department of

Biology

College of Education

Salahaddin University – Erbil

Subject: Entomology

Course Book: 3<sup>rd</sup> Class Students

Lecturer's name: Banaz Sdiq Abdulla

Academic Year: 2023 – 2024

### Course Book

1. Course name	Theoretical Entomology
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:

**5. Time (in hours) per week**

**For example, Theory: 4  
Practical: 12 Hours**

**6. Office hours**

**Approximately 18 Hours per week**

**7. Course code**

**BE302**

**8. Teacher's academic profile**

Education means helping people to learn how to do things and encouraging them to think about what they learn. It is also important for educators to teach ways to find and use information. More specific, education helps and guide individuals to transform from one class to other.

Education is the process of acquiring knowledge, and aims based on objective scientific thinking and confirm rational thinking based on reason and logic and cash Spirit. Teaching is a message written and oral knowledge-based and goal of success in an atmosphere of close communication between education and convincing officials.

The process of teaching a joint operation between the teacher and the student, must therefore involve them and assist them in acquiring the analytical methods and skills necessary to help them see things as they should be, and encourage them to outstanding scientific production and make the learning process more fun linking the topics Article operation life of local and international issues, and to involve students in discussions in order to encourage them to express their point of view. The teaching philosophy is based on the following (teaching is the involvement of students in the educational process and to urge them on the following):

1. Learning and analytical thinking scientific manner.
2. Care to provide students with vocabulary and scientific material references in her first lecture.

- 3.
4. Help students to acquire the skills that will help them see things in accordance with the right to its relations and relative importance.
5. It is important to reveal their student's point of view and learn the way of logical thinking, which helps students to develop analytical skills.
6. The purpose of the exams is to enhance the stock of knowledge of the student throughout the semester.
7. Exams also aim to assist and support students with low performance and student who suffer from shyness in the ability to increase the collection.
8. Looking at this perspective exams help to relieve the sense of pressure, which is usually associated with the examinations.
9. Careful use of modern technology in the teaching process to make the material more useful and fun.
10. Careful self-development by attending courses, workshops, seminars and scientific lectures.

### 9. Keywords

### 10. Course overview:

The Insects are the most diverse and important group of animals on land. Insects are members of a larger group called arthropods (which also includes arachnids, myriapods, and crustaceans). Despite their small size, the here numbers or biomass of insects means that they have a significant impact on the environment and therefore upon our lives. Insects are everywhere. They are, by far, the most common animals on our planet. More than 1.5 million species of insects have been named. This is three times the number of all other animals combined. Even so, some say that the insects that have been given names are only a small fraction of the insects in nature. Many are yet to be discovered. We can find insects in almost every conceivable habitat. Their size, shape, color, biology, and life history are so diverse that it makes the study of insects absolutely fascinating. Without insects, our lives would be vastly different. Insects pollinate many of our fruits, flowers, and vegetables. We would not have much of the produce that we enjoy and rely on without the pollinating services of insects, not to mention honey, beeswax, silk, and other useful products that insects provide. Insects feed on a seemingly endless array of foods. Many insects are omnivorous, meaning that they can eat a variety of foods including plants, fungi, dead animals, decaying organic matter, and nearly anything they encounter in their environment. Still others are specialists in their diet, which means they may rely only on one particular plant or even one specific part of one particular plant to survive. Many insects are predatory or parasitic, either on plants or on other insects or animals, including

people. Such insects are important in nature to help keep pest populations (insects or weeds) at a tolerable level. We call this the balance of nature. Predatory and parasitic insects are very valuable when they attack other animals or plants that we consider to be pests. Insects are very important as primary or secondary decomposers. Without insects to help break down and dispose of wastes, dead animals and plants would accumulate in our environment and it would be messy indeed.

some of the main objectives in this course should be as follow, The students will be able to:

- 1-.get training in collection and preservation of insects.
- 2- Understand morphology of the insects and observe external features of insects
- 3-study the mouthparts, digestive system and reproductive system of insects by dissection and observation
- 4- Understand taxonomic characters of insects
- 5- Identification of different insects of some important families
- 6- Understand the advantage and disadvantage of insects to man and their role in the environment.

### 11.Course objective:

The aim of this course is to introduce students to basic insect biology, including basic taxonomy. Insects as a group make up more than 50% of all the known species of living organisms and insects impact all aspects of our daily lives. We primarily think of insects in the context of their negative impacts: pests of agriculture crops and livestock, disease vectors, pests of our homes, etc. However, insects are also beneficial to human society in many ways. For example, insects are essential pollinators of our crop and ornamental plants, are a valuable food item for many economically and culturally important animals, can be used to control invasive plants and insects, and constitute excellent models for scientific research (e.g. *Drosophila melanogaster*).

By the end of this course students should develop a basic understanding of insect biology and be able to identify different insects to the level of Order. We will assess this understanding using exams, laboratory quizzes, various writing assignments, a laboratory practical and an insect collection. Participation in classroom and laboratory discussion is strongly encouraged – students will occasionally be called upon in class and asked to work together in groups.

To understand basic insect biology, as well as natural history and evolutionary relationships of insect orders and families. To have a deeper understanding of several aspects of the biology of insects. To appreciate the impact that insects have (both positive and negative) on human society, including human health, agriculture, and the environment. Be able to identify the potential impact of different insect species on agriculture, human health, and society in general; to be knowledgeable about potential control strategies. Demonstrate phylogenetic "tree thinking" and be able to categorize insects based on basic ecological, behavioral, morphological, physiological, or developmental attributes.

### 12. Student's obligation

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

- A. Daily activity, absence and quizzes
- B. 1<sup>st</sup>Theory Exam
- C. Reports and seminar
- D. 2<sup>nd</sup> Theory Exam
- E. Insect collecting
- F. Final Theory Exam

### 13. Forms of teaching

Teaching method used in our lab:

- A. Data show and power point
- B. White board
- C. Paper of lectures

### 14. Assessment scheme

No.	Exam (Evaluation)	Marks
1.	Reports, absence and quizzes	15 %
2.	Insect collecting	15%
3.	Theory Exam mean	70 %
9.	Total Scores	100%

### 15. Student learning outcome

The study of insects is an important part of the training of every biology teacher, agriculturist and student of nature. This course is intended to serve as a guide for students and others interested in the study of insects and will help to begin a fascinating study, insects should be observed and studied in the field as well as in the classroom and laboratory so this course will involve field and laboratory work and will give students a better understanding of a number of entomology topics.

- 1- Introducing to the principles basic form and structure (morphology) of insects.
- 2- In the laboratory, students will become comfortable working with and handling live and/or pinned insects, identifying basic insect structures, performing dissections, collecting insects in the field and identifying specimens.
- 3- -students learn how to recognize insects from their relatives depending on the general structure of insects and their life cycle. (Know the basic form and structure (morphology) of insects).
- 4- The advantage and disadvantage of insects to man and their role in the environment its necessary that student try to make connections with their knowledge.
- 5- Students should be familiar with terms, abbreviations, figures and scientific names ...etc. used in this subject.
- 6- Studying the development and metamorphosis of insects with general information's about their biology, behaviour, anatomy and physiology.
7. Understanding the basic principle of insect's classification, nomenclature and identification.
- 7- Review of historical development classification of insects

### 16. Course Reading List and References:

#### ▪ Key references:

- 1- David, B. V. and Ananthakrishnan, T. N. (2004). General and Applied Entomology. 2nd ed. Tata McGraw-hill Publishing Co. Ltd. New Delhi. India. 1184 p.
- 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 Konstantinovich Lopatin .405pp.

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

▪ **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.

**17. 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

Each term should include not less than 16 weeks

**Lecturer's name**

Lecturer's name

**Asst. Prof Dr.**

**BanazS. Abdulla**

Time: **(4.)**

Date:

**18. Practical Topics (If there is any)**

**Insects and its related animal phylum Arthropoda**

**phylum Arthropoda**

Characteristics of phylum Arthropoda, Classification of Phylum Arthropoda– different Classes of Arthropoda and omparison of characters of Class Insecta with Arachnida, Crustacea, Chilopoda,andDiplopoda

What is Entomology?

Characters contributing to the success of insect.

Insects of economic importance

1- Insects as pests

2. Beneficial insects

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(4hrs.)**

Date:

### **Insect Integuments**

Structure: Body wall consists of 3 layers (Fig.1)

1. Inner basement membrane
2. Middle epidermis (or) hypodermis
3. Cuticle

Composition of cuticle

Cuticular appendage

Functions of Body wall

Color production

Lecturer's name

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

Time: **(4hrs.)**

Date:

The head and its appendages. Types of head. (a)  
Hypognathous (b) Prognathous (c) Opisthognathous.

The moulting process

Moulting and Cuticle formation

Moulting is a complex process which involves

1. Apolysis
2. Ecdysis
3. Sclerotization

Control of moulting and associated processes

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Lecturer's name

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

Time: **(4hrs.)**

Date:

Head

The head and its appendages.

Types of head. (a) Hypognathous

(b) Prognathous (c) Opisthognathous

Tentorium

Function of tentorium

Functions of Head

Antennae

Structure of antennae

Function of antennae

Different types of antennae

Lecturer's name

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

Time: **(4hrs.)**

Date:

### **Mouth parts of insects.**

Insect mouthparts divided into two groups:-

- 1-Mandibulate (chewing) mouthparts
- 2-Haustellate or Suctorial mouthparts

Lecturer's name

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



Typical chewing type of MouthParts:

consists of the following parts.

(1) Labrum (upper lip) (2) A pair of mandibles (3) A pair of maxillae (4) Labium (lower lip)

(5) Hypopharynx (tongue)

Mouthparts modification

Time: (4 hrs.)

Date:

### Neck and Thorax

Thoracic nota

Thoracic sterna

Thoracic pleura

Legs

Structure of leg

Leg modifications

Lecturer's name

Asst. Prof. Dr.

Banaz S. Abdulla

Time: (4 hrs.)

Date:

### Insect wings:

Wing area

Wing venation

Based on the presence or absence of wings, class insecta is divided into two subclasses.

1. Apteriygota: 2. Pterygota:

Exopterygota and Endopterygota

Different types of wings

Pterostigma.

Wing coupling apparatus.

Different types of wing coupling mechanisms

Lecturer's name

Asst. Prof. Dr.

Banaz S. Abdulla

Time: (4 hrs.)

Date:

### The abdomen:

Structure of Abdominal segments.

Number of abdomen segment.

Epimorphic development

Anamorphic development

Abdominal Appendages

Abdominal appendages of primitive hexapoda.

Styli and Eversible Vesicles.

Abdominal appendage in Collembola

Lecturer's name

Asst. Prof Dr.

Banaz S. Abdulla

Time: (4 hrs.)

Date:

Larval structures associated with locomotion and attachment. Prolegs  
Sensory structure.  
Cerci  
Different types of cerci  
Gills  
Secretary structure.

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

Alimentary canal is divided into 3 parts:

- 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: (4 hrs.)

Date:

**Excretory system and Circulatory system**

Excretory system:

The organs that are involved in the process of excretion are 1. Malpighian tubules 2. Integument or body wall 3. Tracheal system 4. Alimentary canal 5. Nephrocytes 6. Urate cells 7. Oenocytes 8. Labial glands and 9. Chloride cells

Malpighian tubules

Functions of Malpighian tubules:

Circulatory system:

Components of Circulatory system

1-the diaphragms and sinus

2- Dorsal blood vessel.

3-Accessory pulsatile organs:

Process of blood circulation

1. Diastole

2. Systole

Blood cells:

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: (4 hrs.)

Date:

Different types of hemocytes.  
Functions of blood:

**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

**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

Nervous system can be grouped in to three:

1. Central nervous system (brain,subesophagealganglion, ventral nerve cord)

2. Visceral or sympathetic nervous system:

3. Peripheral nervous system:

Synapse:

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(4 hrs.)**

Date:

Lecturer's name

**Asst. Prof Dr.**

**Banaz S. Abdulla**

Time: **(4 hrs.)**

Date:

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: **(4 hrs.)**

Date:

**Reproductive system**

Reproduction in insects

Male reproductive system: Internal male reproductive organs consists of -a pair of testis, a pair of vasa eferens, seminal vesicle, ejaculatory duct, -accessory glands.

Female reproductive system:

It consists of a pair of ovaries which possess number of ovarioles, a pair of oviducts, common oviduct / Median oviduct , spermatheca , a pair of accessory glands and Bursa copulatrix or copulatory pouch or genital chamber or vagina.

Types of ovarioles :

1. Panoistic

2. 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: **(4 hrs.)**

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: **(4 hrs.)**

Date:

