



Benha University  
Faculty of Science  
Department of Entomology



# Chemistry and Entomology B.Sc. Program Specification



## Chemistry and Entomology B.Sc. Program Specification

### A. Basic Information

<b>Program Title:</b>	Chemistry and Entomology B.Sc. Program
<b>Program Type:</b>	Double
<b>Department:</b>	Entomology Department
<b>Coordinator:</b>	Prof. Dr. Abd El-Wahab A. Ibrahim
<b>Assistant Co-ordinator:</b>	Dr. Mohamed M. Baz Dr. Ayman A. Ali

This program is now reviewed by external evaluator and internal evaluator.

External evaluator: Prof. Dr. Abdel Aziz Diab.

Internal evaluator: Prof. Dr. Abd Elwahab Abd El Maksoud.

**The most recent date of the program specification approval: 9/12/2015 (Faculty council; meeting number, 390)**

### B. Professional Information

#### 1. Program general aims

The overall aims of the program are to provide the graduate with the following:

- Demonstration wide background knowledge related to the different branches of entomology and chemistry.
- Producing equipped students with skills that are both of value to future employment as entomologists and transferable to other avenues of employment
- Conceptualizing the economic importance of insects.
- Instruct our students in ways of approaching, analyzing and solving some environmental problems.
- Preparing graduates to be able to undertake a professional research-related career in fields of entomology and chemistry with minimum of further format training
- Design and conduct experimental work, critically evaluate the outcomes, review and report on practice
- Application concepts and theories of chemistry to interpret life's basic processes from cell to organism.
- Recognizing the relationship and interactions among chemistry, entomology and the environment.
- Planning, conduct and evaluate experiment and research and interpret scientific data
- Employing theories and concepts in mathematics and statistics to understand the underlying mechanisms in essential chemical and biological processes of insects.
- Conforming of safety regulations and good practices in the laboratory and the field.
- Working effectively in a team and posses the management and communication skills.
- Exploration it skills and data processing and database management for life long learning and research in entomology and chemistry sciences.



## 2. Intended Learning Outcomes (ILO's)

### 2.a Knowledge and Understanding

On successful completion of the program, the graduate will be able to:

- a.1 Acquire a basic knowledge of fundamental concepts mathematics, physics, biology and other collateral subjects in order to understand principle and theories of entomology.
- a.2 Demonstrate insect classification, insect morphology, anatomy, physiology, histopathology, economic importance of insects and insect management.
- a.3 Define the structure and functions of chemical molecules and formulations in controlling the harmful insects
- a.4 Tell of the basic knowledge in insects classification and distribution and use of the integrated management programs.
- a.5 Aware of the research techniques, including information retrieval, experimental design and statistics, modeling, sampling, taxonomic keys, bioassays, molecular biology, pesticide application, laboratory and field safety.
- a.6 Discover the insect metamorphosis including the wide range dispersal of hexapoda class, expression and regulation of genes.
- a.7 Acquire the ethical and legal issues as well as the basis of quality in the field of entomology and chemistry

### 2.b. Intellectual Skills

By the end of the program, the graduate will be able to:

- b.1 Find and assimilate new information and address much kind of problems using scientific methodology in insects and chemistry sciences.
- b.2 Formulate the data correctly and select an appropriate statistical test hypotheses
- b.3 Evaluate critically the evidence underlying current theories and hypotheses
- b.4 Analyze and interpret quantitative information in graphs, figures, tables and equations.
- b.5 Plan and conduct a research task to solve problem.
- b.6 Undertake a supervised project in workplace setting
- b.7 Apply the investigations in a responsible, safe and ethical manner, paying attention to risk assessment and safety regulation.

### 2.c. Professional and Practical Skills

By the end of the program, the graduate will be able to:

- c.1 Undertake competent, safe, evaluative, reflective and effective laboratory work.
- c.2 Construct several related and integrated information to confirm, make evidence and test hypotheses
- c.3 Write a professional report.
- c.4 Critically apply literature knowledge to comment and evaluate research plan.
- c.5 Use appropriate software to analyze data and apply the suitable statistical treatment
- c.6 Use the light microscope with LCD to investigate the different structures of insect to facilitate
- c.7 Collect and identification of insects in taxonomy and structure adapted to functions in



## Morphology

### 2.d. General Skills

By the end of the program, the graduate will be able to:

- d.1 Use computers and internet for communication, data handling and word processing.
- d.2 Collaborate effectively with teamwork members to maintain independent and critical thinking, effective time-management and positive communication and cooperation with other members of the teamwork.
- d.3 Solve problems on scientific basis.
- d.4 Effectively manage tasks, time, and resources.
- d.5 Search for information and engage in life-long self learning discipline.
- d.6 Help raising public awareness of the benefits of conserving intellectual property rights and scientific patents on the individuals and communities.
- d.7 Modify sense of beauty and neatness

### 3- Academic standards of the program

The program outcomes are derived from the Egyptian National Academic Reference Standards (NARS) for Double programs in Science Faculties (Entomology and Chemistry). Aug. 2009.

### 4- Reference indices (Benchmarks). Not utilized

### 5- Program structure and contents

#### 5.a- Program duration:

The period of study to obtain a B.Sc. degree is 4 academic years (four levels) including 8 semesters. The academic year is divided into two semesters. Each semester extends to 17 weeks. A summer semester extended for 8 weeks is a subject for approval by the faculty council.

#### 5.b- Program structure: to acquire the degree of bachelor in science in the double programme 140 credit hours system.

No. of hours/No of units	Lectures	Practical	Total
	107	33	140

Program	Credit hours
Compulsory	117
Optional	21
Elective	2
Total	140



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Program	Credit hours	Percentage
<b>Basic sciences</b>	36	15.7 %
<b>Humanities (including language)</b>	5	3.6 %
<b>Specialized courses</b>	94	77.1 %
<b>Computer and IT</b>	5	3.6 %
<b>Total</b>	<b>140</b>	<b>100 %</b>

- **Field training:** 6 weeks

### 5.C- Program Courses:

- Symbols in the list and their meanings

Connotation	Symbol
University requirement	Ur
Faculty requirement	Fr
Botany	B
Chemistry	Ch
Entomology	E
Geology	G
Mathematics	M
Physics	Ph
Zoology	Z

### 5.C.1 First level:

1. The student studies (8 credit hours) in first level from the following table (University requirement courses):

Code No.	Course Title	No. of Units	No. of hours/week			level
			Lect.	Exer.	Prac.	
015 Ur	English (1)	2	2	-	-	first
030 Ur	Computer Science (1)	3	2	-	2	first
040 Ur	Computer Science (2)	2	1	-	2	first
050 Ur	Human Rights	1	1	-	-	first



**2. The student studies (18 credit hours) in first level from the following table: (Faculty requirement courses)**

Code No.	Course Title	No. of Units	No. of hours/Week			Level
			Lect.	Exer.	Prac.	
100 M	General Mathematics (1)	3	2	2	-	First
105 M	General Mathematics (2)	3	2	2	-	First
100 Ph	General Physics (1)	2	2	-	-	First
105 Ph	General Physics (2)	2	2	-	-	First
181 Ph	Practical Physics (1)	1	-	-	3	First
180 Ph	Practical Physics (2)	1	-	-	3	First
100 Ch	General Chemistry (1)	2	2	-	-	First
105 Ch	General Chemistry (2)	2	2	-	-	First
181 Ch	Practical Chemistry (1)	1	-	-	3	first
180 Ch	Practical Chemistry (2)	1	-	-	3	first

**3. The student studies (6 credit hours including two hours from general culture courses) in first level from the following table: (Optional courses)**

Code No.	Course Title	No. of Units	No. of hours/week			level
			Lect.	Exer.	Prac.	
100 Z	General Zoology (1)	2	1	-	2	first
105 Z	General Zoology (2)	2	1	-	2	first
100 B	General Botany (1)	2	1	-	2	first
105 B	General Botany (2)	2	1	-	2	first
100 G	General Geology (1)	2	1	-	2	first
105 G	General Geology (2)	2	1	-	2	first
111 E	General Entomology (1)	2	1	-	2	first
112 E	General Entomology (2)	2	1	-	2	first
11 Fr	Business Administration	2	2	-	-	first
12 Fr	History of Science	2	2	-	-	first
13 Fr	Healthy Nutrition	2	2	-	-	first
14 Fr	Scientific Thinking	2	2	-	-	first
17 Fr	Principles of labor law	1	1	-	-	first
19 Fr	Selected topics from the history of modern Egypt	1	1	-	-	first

- A student who wants to study Entomology it is imperative study 111EZ and 112E courses.



### 5.C.2 Second level:

The student studies the following credit hours in second level from the following table:

Code No.	Course Title		No. of Units	No. of hours/Week			Level
				Lect.	Exer.	Prac.	
<b>First semester</b>							
215 Ch	Environmental green organic chemistry		2	2	-	-	second
217 Ch	Aliphatic organic chemistry		3	2	-	3	second
231 Ch	Thermodynamic chemistry		2	2	-	-	second
221E	Cell biology		2	1	-	2	Second
237E	Insect morphology		2	1	-	2	Second
239E	Insect relationship and biosphere		2	1	-	2	Second
MS241	Biostatistics		3	3	-	-	Second
256E	Insect physiology (1)	The student select one course	4	3	-	3	Second
284E	Economic insects		3	2	-	2	Second
<b>No. of Hours</b>			<b>19</b>				
<b>Second semester</b>							
212 Ch	Aromatic organic chemistry (1)		2	2	1	-	second
222 Ch	Inorganic chemistry		2	2	1	-	second
234 Ch	Electrochemistry		2	2	1	-	second
242 Ch	Analytical chemistry		3	2	-	3	second
234E	Insect taxonomy and classification		3	2	-	3	Second
235 G	Crystallography and optical mineralogy		3	2	-	2	Second
232B	Botany taxonomy		3	2	-	2	second
214M	Differential Equations for non mathematics students	The student select one course	3	2	-	2	second
<b>No. of Hours</b>			<b>18</b>				



### 5.C.3 Third level:

The student studies the following credit hours in third level from the following table:

Code No.	Course Title	No. of Units	No. of hours/Week			Level	
			Lect.	Exer.	Prac.		
<b>First semester</b>							
317 Ch	Organic Spectroscopic Chemistry	3	2	-	3	third	
323 Ch	Transition elements and Coordination Chemistry	2	2	-	-	third	
333 Ch	Chemical kinetics	1	1	-	-	third	
333E	Insect collection and preservation	3	1	-	4	Third	
341E	Insect ecology and behavior	3	2	-	2	Third	
377E	Medical and veterinary insects	3	2	-	3	Third	
319Ch	Chemistry of petroleum and petrochemicals	The student select one course	3	2	-	3	Third
325Ch	Physical Chemistry (3)		3	3	-	-	Third
<b>No. of Hours</b>		<b>18</b>					
<b>Second semester</b>							
310 Ch	Organic reaction mechanism (2)	2	2	1	-	third	
338 Ch	Surface, catalysis, colloid and solid state chemistry	2	2	-	-	third	
334E	Toxicology	3	2	-	2	Third	
343E	Aquatic Insect	3	2	-	2	Third	
382E	Plant Pests and transmission diseases	3	2	-	3	Third	
396E	Insect pathology and immunology	2	1	-	2	Third	
326 Ch	Inorganic chemistry (3)	The student select one course	3	3	-	-	third
342 Ch	Analytical chemistry (2)		3	2	-	3	third
<b>No. of Hours</b>		<b>18</b>					





#### 5.C.4 Fourth level:

The student studies the following credit hours in fourth level from the following table:

Code No.	Course Title	No. of Units	No. of hours/Week			Level	
			Lect.	Exer.	Prac.		
<b>First semester</b>							
433Ch	Applied Electrochemistry (2)	1	1	-	-	Fourth	
443Ch	Mechanical Analytical Chemistry (2)	3	2	-	3	Fourth	
453E	Integrated Pest Management	3	2	-	3	Fourth	
491E	Field training	4	1	-	6	Third	
291B	General Microbiology	3	2	-	2	Second	
419Ch	Chemistry of carbohydrates, amino acids and lipids	The student select one course	3	2	-	3	fourth
440Ch	Advanced analytical chemistry		3	3	-	-	fourth
<b>No. of Hours</b>		<b>17</b>					
<b>Second semester</b>							
400 E/ Ch	Research and essay	2	-	-	-	fourth	
418Ch	Chemistry of Heterocyclic Compounds	2	2	-	-	fourth	
424Ch	Advanced inorganic Chemistry	2	2	-	-	Fourth	
458E	Pollution and Poison	3	2	-	3	Fourth	
461E	Insect Resistance	3	2	-	3	Fourth	
215B	Principles of genetics	3	2	-	2	Second	
310B	Molecular genetics	The student select one course	3	2	-	2	fourth
323Ph	Biophysics		3	2	-	3	fourth
<b>No. of Hours</b>		<b>18</b>					



## 6- Contents of the Courses

See course specification (Appendix 4)

## 7- Program admission requirements:

- The criteria for admitting students BSC program in science is the total score in the national secondary school examination (usually to exceed 88%) as well as a geographic factor: admission criteria are essentially set by the Higher Education authorities.
- The number of students to attend the program in its first year (preparatory year is 650 students), (credit hours). It has been ratified by the **Higher Education authorities**. the faculty program duration is 4 years (8 semesters at least). i.e. 4 years, autumn and spring.
- Faculty of Benha Science accepts transfer students from other science faculties; provided that the number of credit hours that were studied not more than 60% of the total number of credit hours necessary for his graduation. The student is exempt from the courses studied by successfully whatever their level.
- The final secondary school degree (thanaweya Amma), the mathematics section and science section) or their equivalent is a prerequisite for admission to faculty of science. Admission to Benha University is restricted to students living in some neighboring districts. The number of students legible to apply for admission to faculty programs is about 738. Among those, a maximum of number of xxx are admitted to the faculty. Students at any of the programs varied among the faculty programs.

## 8- Regulations for progression and program completion:

Administration and acceptance produces the plan of registration and its procedure, list of students, admitted to the course of the desired program, study groups, schedule of program, and distribution of the academic advisor and approved his/her role. The total courses for each individual student provided in cards and academic record data are introduced into special documents and approved by the faculty. The academic advisor helps and guides the students on the process and appropriate selection based on the desired of each student. The student can be registered from the week before the start of first semester, and admitted to the program at the first week of the semester. When the student registered for any course at any level, he or she should have been succeeded in the prerequisite course. The course can be study coincidentally with the request course. The student how failed to register, due to any urgent reason, can be register during the second week provide the approval of the faculty dean. In case of the student registered for the essay and research course in any of the double programs, he or she should be free (eligible) to choose it from any of these programs.

### ▪ Joining the Program:

1. Vice Dean for Education and Student Affairs supervises on the implementation of the registration rules and procedures and prepare menus for each of the study groups, schedule, distribute students gentlemen academic advisers, processing cards courses for students



which is about cards individual for each course as well as cards total for each student, that academic record data in accredited private records, and the completion of enrollment of students in the first week of the start of the semester.

2. Students may register early, after announcing the results of the end of the spring.
3. Take into account when you log decision student success in Prerequisite if any.
4. A student who was not able to register for compelling reasons approved by the Student Affairs Committee and approved by the College Board to register record late in the additional period for registration (the second week).
5. Student selects one branch to research and essay from two specialized branches.

▪ **Study load:**

Students are allowed to register in at least 14 credit hours and no more than 19 credit hours per semester. With the exception of the following cases:

1. A student can superior (who has a cumulative average of 3 or more) that adds to it two hours, certified in one semester and a maximum of 8 credit hours throughout the study period in decisions, additional optional requirements, specialization departments, college different, that is added appreciation where to CGPA It is not permitted to be an elective requirement for another decision.
2. The College Board may increase the maximum for the academic workload in the last semester of the student up to a maximum of four credit hours to complete graduation requirements.
3. Not allows the student who has a cumulative rate (1) to register in more than 12 credit hours in a semester.

▪ **Additions, deletions, withdraw and modify the path:**

1. Any student after the approval of the academic advisor to add or delete scheduled or two until the end of the second week only study and without prejudice to the burden stipulated.
2. Student may withdraw from the study any decision until the end of the seventh week of the start of registration for the semester with the approval of the academic advisor. The record of this decision in the student's academic record estimate "withdrawn" on the condition that the student does not have absenteeism overruns before the withdrawal. And cases before the forced withdrawal over this period the Commission Education and Student Affairs for consideration and approval of the Faculty Council on the withdrawal shall be without prejudice boarding school student.
3. A student may alter the course of the specialization subject to the completion of the requirements of specialization desirable and not counting credit hours, which the student obtained by not located in the area of the requirements of the new specialization and after the approval of the academic advisor and the Committee on Education and Student Affairs and the College Board on this amendment.

▪ **Stop registration or drop out**

1. Stop registration: the student can apply to stop his registration for one semester and a maximum of four separate classes are connected and for compelling reasons approved by the College Board.



2. Dropout: the student can re-record if he dropouts for maximum two semesters and for compelling reasons approved by the College Board.

▪ **Attendance:**

1. The instructor shall register the presence of students at the start of each lecture theory or process in a practical period Prepared for by the Student Affairs and delivers this record at the end of the semester to manage the affairs of Students.
2. When the student exceeds the absence of 10% of the scheduled hour's instructor shall notify the Department of Affairs Students to guide the first warning to the student.
3. When the student exceeds the proportion of the absence of 20% of the scheduled hour's instructor shall notify the Department Student Affairs to direct second and final warning to the student.
4. If increased absenteeism 25% of the total scheduled hours and the absence of a student without an acceptable excuse Student Affairs Committee and approved by the College Board, student records estimate" deprived" decision and intervention as a result of failure to calculate the cumulative average of the student.
5. If increased absenteeism was 25% and the absence of the student excuse acceptable to the Commission, Education and Student Affairs and approved by the College Board, student records withdraw from the course.
6. In the case of a request student Add a new decision attendance is calculated from the date of registration.

**9- Methods and rules of evaluation of students enrolled in the program:**

**Rating:** The exam is evaluated each courses at 100 degrees and distributed degrees scheduled as the follows:

**9.1 courses which did not include the part "practical"**

Method of Assessment	Marks	learning outcomes assessed	Weighting
Midterm exam & Semester work	10	Measure knowledge, understanding (a.1-a.4), intellectual skills (b.1, b.3), professional (c.1) and general skills (d.1, d.5)	10%
Final Oral Exam	10	Measure knowledge, understanding (a.2,a.4), intellectual skills (b.3- b.5), professional (c.1-c.3) and general skills (d.3, d.6-d.7)	10 %
Final Term Examination	80	Measure knowledge, understanding (a.1-a.3, a.5,a.7), intellectual skills (b.1-b7), professional (c.1-c.3, c.7), and general skills (d.2, d.7)	80%
<b>Total</b>	<b>100</b>		<b>100 %</b>



### 9.2 courses practical separate

Method of Assessment	Marks	learning outcomes assessed	Weighting
Midterm exam & Semester work	10	Measure knowledge, understanding (a.2), intellectual skills (b.4), professional (c.6), and general skills (d.1-d.2)	20%
Final Oral Exam	10	Measure knowledge, understanding (a.2-a.3), intellectual skills (b.4,b.7), professional (c.7), and general skills (d.4-d.5)	20 %
Final practical Examination	80	Measure knowledge, understanding (a.2-a.3), intellectual skills (b.4,b.7), professional (c.7), and general skills (d.4-d.5)	60%
<b>Total</b>	<b>100</b>		<b>100 %</b>

### 9.3 courses which include part "practical"

Part	Marks	Method of Assessment	Marks	learning outcomes assessed	Weighting
<b>Practical part</b>	<b>40</b>	Mid term exam & Semester work for practical part	8	Measure knowledge, understanding (a.1-a.4), intellectual skills (b.1-b.3), professional (c.1-c.2,c.6), (d.1-d.3)	8 %
		Final Oral Exam for practical part	8	Measure knowledge, understanding (a.1-a.4), intellectual skills (b.1-b.3), professional (c.1-c.2,c.6), and general skills (d.1-d.3)	8 %
		Final practical Examination	24	Measure knowledge, understanding (a.1-a.6), intellectual skills (b.1-b.6), professional (c.1-2.c.2,2.c.5), and general skills (d.1-d.5)	24 %
<b>Theoretical part</b>	<b>60</b>	Mid term exam & Semester work for theoretical part	6	Measure knowledge, understanding, intellectual and general skills	6 %
		Final Oral Exam for theoretical part	6	Measure knowledge, understanding and intellectual skills	6 %



		Final Term Examination	6	Measure knowledge, understanding (a.3-a.7), intellectual skills (b.3-b.7), professional (c.4-c.7), and general skills (d.3-d.7)	48%
	<b>100</b>		100		<b>100 %</b>

#### **9.4 Course search and essay**

A - 60% of the total score for the course of the various activities carried out by the student during his study of the course.

B- 60% of the total scores for the course of the discussion session

The following grading system is applied:

Grades	Symbols	No. of points	Degree
Excellent	A	4	90% — 100%
	A-	3.7	85% — <90%
Very Good	B+	3.3	80% — <85%
	B	3	75% — <80%
Good	B-	2.7	70% — <75%
	C+	2.3	65% — <70%
Pass	C	2	60% — <65%
Fail	F	0	<60%
Absent	F-	0	—

#### **10. Teaching and learning strategies used in the program:**

- a. Outcome based learning.
- b. Brainstorming strategy.
- c. Problem-solving strategy.
- d. Cooperative learning strategy.
- e. Independent Study strategy.
- f. E-learning



### 11. Evaluation of program:

Evaluator	Tool	Sample
1- Internal Evaluators	Reports	Reports 1-2
2- External Evaluators	Reports	Reports 1-2
3- Senior Students	Questionnaire	Questionnaire not less than 25%
4- Alumni	Questionnaire	Questionnaire not less than 25%
5- Stakeholders	Questionnaire, interview	Representative for all sectors

**The personal responsible for the program:** Prof. Dr. Faten Faried Abu Eldahb

**Signature:** Prof. Dr. Faten Faried Abu Eldahb

**Date:** 2015/2016



## National Academic Reference Standards (NARS) for Entomology and Chemistry B.Sc. Program

In addition of the general attributes of the graduate of science, the graduate of the chemistry /zoology program should be able to:

1. Demonstrate wide integrated knowledge related to different branches of Chemistry and Entomology.
2. Develop knowledge and experience of working with contemporary laboratory techniques relevant to different disciplines in Chemistry and Entomology.
3. Design and conduct experimental work, critically evaluate the outcomes, review and report on practice.
4. Explain the life's basic processes in relation to organisms and ecosystems.
5. Demonstrate essential knowledge, from an integrated point of view, of theories, facts, concepts and essentials of chemistry and entomology
6. Recognize the relationship and interactions among Chemistry, Entomology and the environment.
7. Employ theories and concepts in mathematics and statistics to interpret the underlying mechanisms of the essential processes in Chemistry and Entomology.
8. Conform to safety regulations and good practices in the laboratory and the field.
9. Abide by the legislations and ethics related to the environment preservation and human health and welfare.

### Knowledge and Understanding:

1. Develop knowledge and comprehension of the theories, facts, concepts, fundamentals and techniques related to the fields of chemistry and entomology.
2. Acquire the essential knowledge in mathematics, physics, biology and other collateral subjects in order to understand the recent advances in chemistry and entomology.
3. Exhibit knowledge of the principles and procedures used in chemical analyses as well as in characterization and structural investigation of compounds.
4. Characterize the chemical nature and behavior of the functional groups in different types of molecules with special focus on insecticides
5. Demonstrate familiarity and comprehension of terminology, nomenclature and contemporary tools used for the classification systems of insects.
6. Demonstrate understanding of how the chemistry of biological molecules determines their biological functions.





7. Enumerate the economic importance of the insects and the programs of insect management and control.

### **Intellectual Skills:**

1. Test, evaluate and criticize an existing piece of information in the light of evidence provided by recent advances in zoology.
2. Analyze, evaluate and interpret qualitative and quantitative scientific data relevant to various subjects of chemistry and zoology.
3. Construct several lines of related information to confirm, make evidence and test hypotheses related to recent progresses in research such as stem cell and applications of nano-technology in biology.
4. Breakdown, synthesizes, reconstruct and reformulate a bulk of information such as pathways for biosynthesis of biologically active compounds or macromolecules.
5. Analyze and interpret quantitative data in graphs, figures, tables and other sources of information
6. Postulate and deduce mechanisms and procedures to deal with scientific problems relevant to advanced approaches in zoology and chemistry.
7. Link and integrate subject-specific theories, concepts and principles such as relationship between genes and their products, interactions and modulation of the actions of different types of physiological regulators in animals.
8. Combine knowledge gained from different sources to postulate the role of various cell signaling mechanisms in regulating cellular functions and growth.

### **Professional and Practical Skills:**

1. Plan, and conduct investigations using appropriate procedures and techniques. Write structural reports on the data in accordance with the standard scientific guide lines
2. Use contemporary laboratory equipment, instruments, and tools efficiently in a safe, ethical and responsible manner to investigate living organisms and biological systems
3. Solve problems using a range of formats and approaches.3
4. Handle chemical materials and biological samples safely taking into consideration their physical and chemical properties to avoid hazards associated with their use
5. Employ appropriate statistical and computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and zoology.



6. Search and evaluate the validity, credibility, and relevance of literature in a critical thinking approach
7. Consider variations inherent in dealing with biological materials such as sample size, accuracy, precision and calibration
8. Employ contemporary information retrieval, modeling approaches, taxonomic keys, bioassays and tools of molecular biology
9. Collect and preserve animal samples and prepare sections for microscopic examination and identification of different types of cells and tissues.

**General Skills:**

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, delegate tasks, and set clear guidelines and performance.
3. Think independently, and solve problems on scientific basis.
4. Work in a team effectively, manage time, collaborate and communicate with others positive
5. Address the community linked problems with considerable attention to the community ethics and traditions
6. Acquire self- and life-long learning.
7. Deal with property rights legally and ethically.
8. Exhibit the sense of beauty and neatness.



Benha University  
Faculty of Science  
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# Medical Entomology and Microbiology B.Sc. Program Specification



## Medical Entomology and Microbiology B.Sc. Program Specification

### A. Basic Information

<b>Program Title:</b>	Medical Entomology and Microbiology B.Sc. Program
<b>Program Type:</b>	Double
<b>Department:</b>	Entomology Department
<b>Coordinator:</b>	Prof. Dr. Abd El-Wahab A. Ibrahim
<b>Assistant Co-ordinator:</b>	Dr. Yasser A. El-Sayed Dr. Mostafa Y. Nassar & Dr. Mohamed M. Baz

This program is now reviewed by external evaluator and internal evaluator.

External evaluator: Prof. Dr. Abedel Aziz Diab.

Internal evaluator: Prof. Dr. Abd Elwahab Abd El Maksoud.

**The most recent date of the program specification approval: 9/12/2015 (Faculty council; meeting number, 390)**

### B. Professional Information

#### 1. Program general aims

The overall aims of the program are to provide the graduate with the following:

- Providing students with information's available for studying the insects, their activities, and their interrelations with the environment.
- Developing knowledge and experience of working with advanced laboratory techniques relevant to different disciplines in microbiology and entomology.
- Demonstration essential knowledge, from an integrated point of view, of theories, facts, concepts and essentials of entomology and microbiology.
- Recognizing the basic of medical microbiology and microbial biotechnology
- Instruct our students in ways of approaching, analyzing and solving some environmental problems.
- Preparation graduates to be able to undertake a professional research-related career in fields of entomology and chemistry with minimum of further format training
- Designing and conduct experimental work, critically evaluate the outcomes, review and report on practice
- Application concepts and theories of chemistry to interpret life's basic processes from cell to organism.
- Recognizing the relationship and interactions among chemistry, entomology and the environment.
- Conformation to safety regulations and good practices in the laboratory and the field.
- Abide by the legislations and ethics related to the environment preservation and human health and welfare.
- Recognize concepts of bio-diversity and maintaining of natural resources.



m. Explore it skills and data processing and database management for life long learning and research in entomology, chemistry and microbiology sciences.

## 2. Intended Learning Outcomes (ILO's)

### 2.a Knowledge and Understanding

On successful completion of the program, the graduate will be able to:

- a.1 Develop knowledge and comprehension of the theories, facts, concepts, fundamentals and techniques related to the fields of medical entomology and microbiology.
- a.2 Acquire the essential knowledge in mathematics, physics, biology and other collateral subjects in order to understand the advanced topics of microbiology and entomology.
- a.3 Aware of insect-borne disease and bionomics with other organisms
- a.4 Demonstrate the structure and functions of insect and microorganisms with use infected microbes in controlling the harmful insects
- a.5 State of the basic knowledge in insects classification and distribution and use of the integrated management programs.
- a.6 Aware of the research techniques, including information retrieval, experimental design and statistics, modeling, sampling, taxonomic keys, bioassays, molecular biology, pesticide application, laboratory and field safety.
- a.7 Enumerate the economic importance of the insects and the programs of insect management and control.
- a.8 Acquire the ethical and legal issues as well as the basis of quality in the field of entomology and microbiology.

### 2.b Intellectual Skills

By the end of the program, the graduate will be able to:

- b.1 Test, evaluate and criticize an existing piece of information in the light of evidence provided by recent advances in entomology and microbiology.
- b.2 Formulate the data correctly and select an appropriate statistical test hypotheses
- b.3 Evaluate critically the evidence underlying current theories and hypotheses
- b.4 Analyze and interpret quantitative information in graphs, figures, tables and equations.
- b.5 Plan and conduct a research task to solve problem.
- b.6 Undertake a supervised project in workplace setting
- b.7 Apply the investigations in a responsible, safe and ethical manner, paying attention to risk assessment and safety regulation.

### 2.c Professional and Practical Skills

By the end of the program, the graduate will be able to:

- c.1 Plan, design, and conduct investigations using appropriate techniques and write structural reports on the data in accordance with the standard scientific guide lines
- c.2 Analyze experimental results and determine their strength and validity
- c.3 Continue to learn through further training of professional or equivalent nature
- c.4 Write a professional report.



- c.5 Critically apply literature knowledge to comment and evaluate research plan.
- c.6 Use appropriate software to analyze data and apply the suitable statistical treatment.
- c.7 Identification of medical insects and adapted them in diseases transmission.

## 2.d General Skills

By the end of the program, the graduate will be able to:

- d.1 Analyze, evaluate and interpret qualitative and quantitative scientific data relevant to the various subjects of entomology.
- d.2 Use computers and internet for communication, data handling and word processing.
- d.3 Collaborate effectively with teamwork members to maintain independent and critical thinking, effective time-management and positive communication and cooperation with other members of the teamwork.
- d.4 Solve problems on scientific basis.
- d.5 Effectively manage tasks, time, and resources.
- d.6 Help raising public awareness of the benefits of conserving intellectual property rights and scientific patents on the individuals and communities.
- d.7 Develop lines of argument and appropriate judgment in accordance with scientific theories and concepts.

## 3- Academic standards of the program

The program outcomes are derived from the Egyptian National Academic Reference Standards (NARS) for Double programs in Science Faculties (Medical Entomology and Microbiology). Aug. 2009

## 4- Reference indices (Benchmarks). Not utilized

## 5- Program structure and contents

### 5.a- Program duration:

The period of study to obtain a B.Sc. degree is 4 academic years (four levels) including 8 semesters. The academic year is divided into two semesters. Each semester extends to 17 weeks. A summer semester extended for 8 weeks is a subject for approval by the faculty council.

**5.b- Program structure:** to acquire the degree of bachelor in science in the double programme 140 credit hours system.

No. of hours/No of units	Lectures	Practical	Total
		<b>107</b>	<b>33</b>

Program	Credit hours
Compulsory	111
Optional	27
Elective	2
<b>Total</b>	<b>140</b>



Program	Credit hours	Percentage
<b>Basic sciences</b>	33	23.6 %
<b>Humanities (including language)</b>	5	3.6 %
<b>Specialized courses</b>	97	69.2 %
<b>Computer and IT</b>	5	3.6 %
<b>Total</b>	140	100 %

- **Field training: 6 weeks**

### 5.C- Program Courses:

- Symbols in the list and their meanings

Connotation	Symbol
University requirement	Ur
Faculty requirement	Fr
Botany	B
Chemistry	Ch
Entomology	E
Geology	G
Mathematics	M
Physics	Ph
Zoology	Z

### 5.C.1 First level:

1. The student studies (8 credit hours) in first level from the following table (University requirement courses):

Code No.	Course Title	No. of Units	No. of hours/week			level
			Lect.	Exer.	Prac.	
015 Ur	English (1)	2	2	-	-	first
030 Ur	Computer Science (1)	3	2	-	2	first
040 Ur	Computer Science (2)	2	1	-	2	first
050 Ur	Human Rights	1	1	-	-	first



**2. The student studies (18 credit hours) in first level from the following table: (Faculty requirement courses)**

Code No.	Course Title	No. of Units	No. of hours/Week			Level
			Lect.	Exer.	Prac.	
100 M	General Mathematics (1)	3	2	2	-	First
105 M	General Mathematics (2)	3	2	2	-	First
100 Ph	General Physics (1)	2	2	-	-	First
105 Ph	General Physics (2)	2	2	-	-	First
181 Ph	Practical Physics (1)	1	-	-	3	First
180 Ph	Practical Physics (2)	1	-	-	3	First
100 Ch	General Chemistry (1)	2	2	-	-	First
105 Ch	General Chemistry (2)	2	2	-	-	First
181 Ch	Practical Chemistry (1)	1	-	-	3	first
180 Ch	Practical Chemistry (2)	1	-	-	3	first

**3. The student studies (6 credit hours including two hours from general culture courses) in first level from the following table: (Optional courses)**

Code No.	Course Title	No. of Units	No. of hours/week			level
			Lect.	Exer.	Prac.	
100 Z	General Zoology (1)	2	1	-	2	first
105 Z	General Zoology (2)	2	1	-	2	first
100 B	General Botany (1)	2	1	-	2	first
105 B	General Botany (2)	2	1	-	2	first
100 G	General Geology (1)	2	1	-	2	first
105 G	General Geology (2)	2	1	-	2	first
111 E	General Entomology (1)	2	1	-	2	first
112 E	General Entomology (2)	2	1	-	2	first
11 Fr	Business Administration	2	2	-	-	first
12 Fr	History of Science	2	2	-	-	first
13 Fr	Healthy Nutrition	2	2	-	-	first
14 Fr	Scientific Thinking	2	2	-	-	first
17 Fr	Principles of labor law	1	1	-	-	first
19 Fr	Selected topics from the history of modern Egypt	1	1	-	-	first

- A student who wants to study Entomology it is imperative study 111EZ and 112E courses.





### 5.C.2 Second level:

The student studies the following credit hours in second level from the following table:

Code No.	Course Title		No. of Units	No. of hours/Week			Level
				Lect.	Exer.	Prac.	
<b>First semester</b>							
221B	Plant morphology and Anatomy		3	2	-	2	Second
251B	Plant physiology		3	2	-	2	Second
291B	General microbiology		3	2	-	2	Second
221E	Cell biology		2	1	-	2	Second
237E	Insect morphology		2	1	-	2	Second
241M	Biostatistic		3	3	-	-	Second
240E	General entomology (3)	The student select one course	3	2	-	2	Second
219G	Plant fossils		3	2	-	2	Second
<b>No. of Hours</b>			<b>19</b>				
<b>Second semester</b>							
212B	Molecular biology		2	2	-	-	Second
232B	Plant taxonomy		3	2	-	2	Second
262B	Fungi classification (1)		3	2	-	2	Second
234E	Taxonomy and systematic		3	2	-	3	Second
239E	Insects relations and biosphere		2	1	-	2	Second
216Ch	Aromatic organic chemistry		3	2	-	2	Second
256E	Insect physiology (1)	The student select one course	4	3	-	3	second
284E	Economic insects		3	2	-	2	second
<b>No. of Hours</b>			<b>19</b>				



### 5.C.3 Third level:

The student studies the following credit hours in third level from the following table:

Code No.	Course Title	No. of Units	No. of hours/Week			Level	
			Lect.	Exer.	Prac.		
<b>First semester</b>							
363B	Physiology of fungi	3	2	-	2	Third	
393B	Microbial toxicant	2	2	-	-	Third	
333E	Insect collection and preservation	3	1	-	4	Third	
341E	Insect ecology and behavior	3	2	-	2	Third	
377E	Medical and veterinary insects	3	2	-	3	Third	
343E	Aquatic insects	The student select one course	3	2	-	2	Third
359E	New trends control		3	2	-	2	Third
<b>No. of Hours</b>		<b>17</b>					
<b>Second semester</b>							
310B	Molecular Genetics	3	2	-	2	Third	
396B	Industrial microbiology	3	2	-	2	Third	
334E	Toxicology	3	2		2	Third	
382E	Plant Pests and transmission diseases	3	2		3	Third	
396E	Insect pathology and immunology	2	1	-	2	Third	
318 B	Immunity	The student select one course	3	2	-	2	third
344Ph	Radiation Physics		3	3	-	-	third
<b>No. of Hours</b>		<b>17</b>					



#### 5.C.4 Fourth level:

The student studies the following credit hours in fourth level from the following table:

Code No.	Course Title		No. of Units	No. of hours/Week			Level
				Lect.	Exer.	Prac.	
<b>First semester</b>							
213B	Medical microbiology		3	2	-	2	Second
271B	Bacteriology		3	2	-	2	Second
273B	Algology		3	2	-	2	Second
281B	Virology		3	2	-	2	Second
491E	Field training		4	1	-	6	Fourth
453E	IPM	The student select one course	3	2	-	3	fourth
461E	Insect resistance		3	2	-	3	fourth
<b>No. of Hours</b>			<b>19</b>				
<b>Second semester</b>							
400B&E	Research and Essay		2	2	-	-	Fourth
494B	Microbial ecology		3	2	-	3	Fourth
352B	Phytochemistry		3	2	-	2	Third
458E	Pollution & toxicology		3	2	-	3	Fourth
323Ph	Biophysics		3	2	-	3	Third
453E	IPM	The student select one course	3	2	-	3	fourth
461E	Insect resistance		3	2	-	3	fourth
<b>No. of Hours</b>			<b>17</b>				

#### 6- Contents of the Courses

See course specification (Appendix 4)

#### 7- Program admission requirements:

- The criteria for admitting students BSC program in science is the total score in the national secondary school examination (usually to exceed 88%) as well as a geographic factor: admission criteria are essentially set by the Higher Education authorities.
- The number of students to attend the program in its first year (preparatory year is 650 students), (credit hours). It has been ratified by the **Higher Education authorities** .the faculty pro-gram duration is 4 years (8 semesters at least). i.e. 4 years, autumn and spring.



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- Faculty of Benha Science accepts transfer students from other science faculties; provided that the number of credit hours that were studied not more than 60% of the total number of credit hours necessary for his graduation. The student is exempt from the courses studied by successfully whatever their level.
- The final secondary school degree (thanaweya Amma), the mathematics section and science section) or their equivalent is a prerequisite for admission to faculty of science. Admission to Benha University is restricted to students living in some neighboring districts. The number of students legible to apply for admission to faculty programs is about 738. Among those, a maximum of number of xxx are admitted to the faculty. Students at any of the programs varied among the faculty programs.

### **8- Regulations for progression and program completion:**

Administration and acceptance produces the plan of registration and its procedure, list of students, admitted to the course of the desired program, study groups, schedule of pro-gram, and distribution of the academic advisor and approved his/her role. The total courses for each individual student provided in cards and academic record data are introduced into special documents and approved by the faculty. The academic advisor helps and guides the students on the process and appropriate selection based on the desired of each student. The student can be registered from the week before the start of first semester, and admitted to the program at the first week of the semester. When the student registered for any course at any level, he or she should have been succeeded in the prerequisite course. The course can be study coincidentally with the request course. The student how failed to register, due to any urgent reason, can be register during the second week provide the approval of the faculty dean. In case of the student registered for the essay and research course in any of the double programs, he or she should be free (eligible) to choose it from any of these programs.

#### **▪ Joining the Program:**

1. Vice Dean for Education and Student Affairs supervises on the implementation of the registration rules and procedures and prepare menus for each of the study groups, schedule, distribute students gentlemen academic advisers, processing cards courses for students which is about cards individual for each course as well as cards total for each student, that academic record data in accredited private records, and the completion of enrollment of students in the first week of the start of the semester.
2. Students may register early, after announcing the results of the end of the spring.
3. Take into account when you log decision student success in Prerequisite if any.
4. A student who was not able to register for compelling reasons approved by the
5. Student Affairs Committee and approved by the College Board to register record late in the additional period for registration (the second week).
6. Student selects one branch to research and essay from two specialized branches.

#### **▪ Study load:**

Students are allowed to register in at least 14 credit hours and no more than 19 credit hours per semester. With the exception of the following cases:



1. A student can superior (who has a cumulative average of 3 or more) that adds to it two hours, certified in one semester and a maximum of 8 credit hours throughout the study period in decisions, additional optional requirements, specialization departments, college different, that is added appreciation where to CGPA It is not permitted to be an elective requirement for another decision.
2. The College Board may increase the maximum for the academic workload in the last semester of the student up to a maximum of four credit hours to complete graduation requirements.
3. Not allows the student who has a cumulative rate (1) to register in more than 12 credit hours in a semester.

▪ **Additions, deletions, withdraw and modify the path:**

1. Any student after the approval of the academic advisor to add or delete scheduled or two until the end of the second week only study and without prejudice to the burden stipulated.
2. Student may withdraw from the study any decision until the end of the seventh week of the start of registration for the semester with the approval of the academic advisor. The record of this decision in the student's academic record estimate "withdrawn" on the condition that the student does not have absenteeism overruns before the withdrawal. And cases before the forced withdrawal over this period the Commission Education and Student Affairs for consideration and approval of the Faculty Council on the withdrawal shall be without prejudice boarding school student.
3. A student may alter the course of the specialization subject to the completion of the requirements of specialization desirable and not counting credit hours, which the student obtained by not located in the area of the requirements of the new specialization and after the approval of the academic advisor and the Committee on Education and Student Affairs and the College Board on this amendment.

▪ **Stop registration or drop out**

1. Stop registration: the student can apply to stop his registration for one semester and a maximum of four separate classes are connected and for compelling reasons approved by the College Board.
2. Dropout: the student can re-record if he dropouts for maximum two semesters and for compelling reasons approved by the College Board.

▪ **Attendance:**

1. The instructor shall register the presence of students at the start of each lecture theory or process in a practical period Prepared for by the Student Affairs and delivers this record at the end of the semester to manage the affairs of Students.
2. When the student exceeds the absence of 10% of the scheduled hour's instructor shall notify the Department of Affairs Students to guide the first warning to the student.
3. When the student exceeds the proportion of the absence of 20% of the scheduled hour's instructor shall notify the Department Student Affairs to direct second and final warning to the student.



4. If increased absenteeism 25% of the total scheduled hours and the absence of a student without an acceptable excuse Student Affairs Committee and approved by the College Board, student records estimate" deprived" decision and intervention as a result of failure to calculate the cumulative average of the student.
5. If increased absenteeism was 25% and the absence of the student excuse acceptable to the Commission, Education and Student Affairs and approved by the College Board, student records withdraw from the course.
6. In the case of a request student Add a new decision attendance is calculated from the date of registration.

### 9- Methods and rules of evaluation of students enrolled in the program:

**Rating:** The exam is evaluated each courses at 100 degrees and distributed degrees scheduled as the follows:

#### 9.1 courses which did not include the part "practical"

Method of Assessment	Marks	learning outcomes assessed	Weighting
Midterm exam & Semester work	10	Measure knowledge, understanding (a.1-a.4), intellectual skills (b.1, b.3), professional (c.1) and general skills (d.1, d.5)	10%
Final Oral Exam	10	Measure knowledge, understanding (a.2,a.4), intellectual skills (b.3- b.5), professional (c.1-c.3) and general skills (d.3, d.6-d.7)	10 %
Final Term Examination	80	Measure knowledge, understanding (a.1-a.3, a.5,a.7), intellectual skills (b.1-b7), professional (c.1-c.3, c.7), and general skills (d.2, d.7)	80%
<b>Total</b>	<b>100</b>		<b>100 %</b>

#### 9.2 courses practical separate

Method of Assessment	Marks	learning outcomes assessed	Weighting
Midterm exam & Semester work	10	Measure knowledge, understanding (a.2), intellectual skills (b.4), professional (c.6), and general skills (d.1-d.2)	20%
Final Oral Exam	10	Measure knowledge, understanding (a.2-a.3), intellectual skills (b.4,b.7), professional (c.7), and general skills	20 %



		(d.4-d.5)	
Final practical Examination	80	Measure knowledge, understanding (a.2-a.3), intellectual skills (b.4,b.7), professional (c.7), and general skills (d.4-d.5)	60%
<b>Total</b>	<b>100</b>		<b>100 %</b>

### 9.3 courses which include part "practical"

Part	Marks	Method of Assessment	Marks	learning outcomes assessed	Weighting
<b>Practical part</b>	<b>40</b>	Mid term exam & Semester work for practical part	8	Measure knowledge, understanding (a.1-a.4), intellectual skills (b.1-b.3), professional (c.1-c.2,c.6), (d.1-d.3)	8 %
		Final Oral Exam for practical part	8	Measure knowledge, understanding (a.1-a.4), intellectual skills (b.1-b.3), professional (c.1-c.2,c.6), and general skills (d.1-d.3)	8 %
		Final practical Examination	24	Measure knowledge, understanding (a.1-a.6), intellectual skills (b.1-b.6), professional (c.1-2.c.2,2.c.5), and general skills (d.1-d.5)	24 %
<b>Theoretical part</b>	<b>60</b>	Mid term exam & Semester work for theoretical part	6	Measure knowledge, understanding, intellectual and general skills	6 %
		Final Oral Exam for theoretical part	6	Measure knowledge, understanding and intellectual skills	6 %
		Final Term Examination	6	Measure knowledge, understanding (a.3-a.7), intellectual skills (b.3-b.7), professional (c.4-c.7), and general skills (d.3-d.7)	48%
	<b>100</b>		<b>100</b>		<b>100 %</b>



#### **9.4 Course search and essay**

A - 60% of the total score for the course of the various activities carried out by the student during his study of the course.

B- 60% of the total scores for the course of the discussion session

The following grading system is applied:

Grades	Symbols	No. of points	Degree
Excellent	A	4	90% — 100%
	A-	3.7	85% — <90%
Very Good	B+	3.3	80% — <85%
	B	3	75% — <80%
Good	B-	2.7	70% — <75%
	C+	2.3	65% — <70%
Pass	C	2	60% — <65%
Fail	F	0	<60%
Absent	F-	0	—

#### **10. Teaching and learning strategies used in the program:**

- a. Outcome based learning.
- b. Brainstorming strategy.
- c. Problem-solving strategy.
- d. Cooperative learning strategy.
- e. Independent Study strategy.

#### **11. Evaluation of program:**

Evaluator	Tool	Sample
<b>1- Internal Evaluators</b>	Reports	Reports 1-2
<b>2- External Evaluators</b>	Reports	Reports 1-2
<b>3- Senior Students</b>	Questionnaire	Questionnaire not less than 25%
<b>4- Alumni</b>	Questionnaire	Questionnaire not less than 25%
<b>5- Stakeholders</b>	Questionnaire, interview	Representative for all sectors

**The personal responsible for the program:** Prof. Dr. Faten Faried Abu Eldahb

**Signature:** Prof. Dr. Faten Faried Abu Eldahb

**Date:** 2015/2016





## **National Academic Reference Standards (NARS) for Medical Entomology and Microbiology B.Sc. Program**

In addition of the general attributes of the graduate of science, the graduate of the Medical Entomology and Microbiology program should be able to:

1. Demonstrate wide integrated knowledge related to different branches of Chemistry and Entomology.
2. Develop knowledge and experience of working with contemporary laboratory techniques relevant to different disciplines in Chemistry and Entomology.
3. Design and conduct experimental work, critically evaluate the outcomes, review and report on practice.
4. Explain the life's basic processes in relation to organisms and ecosystems.
5. Demonstrate essential knowledge, from an integrated point of view, of theories, facts, concepts and essentials of chemistry and entomology
6. Recognize the relationship and interactions among chemistry, botany and the environment
7. Apply theories and concepts in mathematics and statistics to understand the underlying mechanisms related to the essential processes in chemistry and botany.
8. Conform to safety regulations and good practices in the laboratory and the field.
9. Abide by the legislations and ethics related to the environment preservation and human health and welfare.

### **Knowledge and Understanding:**

1. Demonstrate knowledge and comprehension of the theories, facts, concepts, fundamentals and techniques related to the fields of chemistry and botany.
2. Acquire the essential knowledge in mathematics, physics, biology and other collateral subjects in order to understand the advanced topics of chemistry and botany.



3. Exhibit knowledge of the principles and procedures used in chemical analyses as well as in characterization and structural investigation of compounds.
4. Characterize the chemical nature and behavior of the functional groups in different types of molecules with special focus on insecticides
5. Demonstrate familiarity and comprehension of terminology, nomenclature and contemporary tools used for the classification systems of insects.
6. Acquire knowledge an understanding of the structure and functions of various types of plant cells in unicellular and multi-cellular organisms
7. Enumerate the economic importance of the insects and the programs of insect management and control.

#### **Intellectual Skills:**

1. Test, evaluate and criticize an existing piece of information in the light of evidence provided by recent advances in botany
2. Analyze, evaluate and, interpret scientific data relevant to the various subjects of chemistry and botany.
3. Construct several lines of related information to confirm, make evidence and test hypotheses.
4. Breakdown, synthesizes, reconstruct and reformulate a bulk of information such as pathways for biosynthesis of biologically active compounds or macromolecules.
5. Analyze and interpret quantitative data in graphs, figures, tables and other sources of information.
6. Postulate and deduce mechanisms and procedures to deal with scientific problems relevant to advanced approaches in zoology and chemistry.
7. Link and integrate subject-specific theories, concepts and principles such as relationship between genes and their products, interactions and modulation of the actions of different types of physiological regulators in plants.
8. Combine knowledge gained from different sources to postulate the role of various cell signaling mechanisms in regulating cellular functions and growth.



### **Professional and Practical Skills:**

1. Plan, and conduct investigations using appropriate procedures and techniques. Write structural reports on the data in accordance with the standard scientific guide lines
2. Use contemporary laboratory equipment, instruments, and tools efficiently in a safe, ethical and responsible manner to investigate living organisms and biological systems
3. Solve problems using a range of formats and approaches.
4. Identify and criticize the different methods used in addressing subject related issues in botany and chemistry.
5. Employ statistical analyses and computational tools to analyze and interpret experimental data in terms of theories relevant to chemistry and botany
6. Search and evaluate the validity, credibility, and relevance of literature in a critical thinking approach
7. Consider variations inherent in dealing with biological materials such as sample size, accuracy, precision and calibration
8. Employ contemporary information retrieval, modeling approaches, taxonomic keys, bioassays and tools of molecular biology
9. Collect and preserve animal samples and prepare sections for microscopic examination and identification of different types of cells and tissues.

### **General Skills:**

1. Use information and communication technology effectively.
2. Identify roles and responsibilities, delegate tasks, and set clear guidelines and performance.
3. Think independently, and solve problems on scientific basis.
4. Work in a team effectively, manage time, collaborate and communicate with others positive



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5. Address the community linked problems with considerable attention to the community ethics and traditions
6. Acquire self- and life-long learning.
7. Deal with property rights legally and ethically.
8. Exhibit the sense of beauty and neatness.