



Course Specifications

Revised November 2019

Course Title:	Cyanobacteria
Course Code:	4014431-3
Program:	Microbiology
Department:	BSc Microbiology
College:	Faculty of Applied Science – Department of Biology
Institution:	UM AL – QURA UNIVERSITY
Revision Date	November 2019

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A. Course Identification

1. Credit hours: 3 hours
2. Course type
a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered: 4 th Year / Level 7
4. Pre-requisites for this course (if any): Bacteriology (4012422-3)
5. Co-requisites for this course (if any): Microbial physiology (4012452-3)

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	50 %
2	Blended		-
3	E-learning		-
4	Correspondence		-
5	Other	30	50 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	42
3	Tutorial	-
4	Practical/Field work/Internship	6
5	Others (specify)	30
	Total	102
Other Learning Hours*		
1	Study	30
2	Assignments	8
3	Library	15
4	Projects/Research Essays/Theses	10
5	Others (specify)	-
	Total	63

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course deals with the occurrence and the role of cyanobacteria in the environment, Cyanobacteria cell structure, classification of cyanobacteria based on morphological, physiological and genetic characterization. Methods and approaches for the isolation and identification of cyanobacteria are considered in the laboratory. Study the factors effect of cyanobacterial growth, nutrition and reproduction of the cyanobacteria. Also, study the cyanobacterial toxins. Important of cyanobacteria in biotechnology for biofuel and cyanophycin production.

2. Course Main Objective

❖ **After completing this course student should be able to:**

- List the role of cyanobacteria in the environment
- Define basic structures and shapes of the different genera of cyanobacteria.
- Differentiate between the fine structure of cyanobacteria and other bacteria and algae.
- Identify and recognize the genera of cyanobacteria
- Recognize the biotechnological important of cyanobacteria in biodiesel, cyanophycin production and as biofertilizers in rice fields.
- Distinguish between the different genera of cyanobacteria.
- Describe the modern methods for identification of cyanobacteria
- Discuss the nutrition requirements of cyanobacteria.
- Understand the metabolism in cyanobacteria
- Describe the reproduction in cyanobacteria
- Define the cyanotoxins and describe its properties.
- Describe the spring blooming phenomena in cyanobacteria.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge: <ul style="list-style-type: none"> ❖ Upon successful completion of this course, the student will be able to: <ul style="list-style-type: none"> • list the role of cyanobacteria in the life and environment • Recognize and classify of cyanobacteria I genera • Describe the structures of cyanobacteria. • List the types of pigments in cyanobacteria • Memorize the metabolism in cyanobacteria • Write techniques for isolation and identification of cyanobacteria • List the different order, families, genera and species of cyanobacteria • Describe the general characteristics of cyanobacteria • Describe the reproduction in cyanobacteria • List the types of toxins produced from cyanobacteria • Define the cyanotoxins and describe its properties. 	
2	Skills:	

CLOs		Aligned PLOs
2.1	<p>Cognitive skills to be developed</p> <ul style="list-style-type: none"> ❖ Having successfully completed the course students should be able to: <ul style="list-style-type: none"> • Explain the fine structure of cyanobacteria • Distinguish between the different genera of cyanobacteria. • Discuss mechanism of the nitrogen fixation on cyanobacteria • Interpret how cyanobacteria synthesis its energy. • Explain why cyanobacteria do not need sugar as carbon source in its metabolism. • Discuss the photosynthesis in Cyanobacteria. • Compare between the different Genera of Cyanobacteria. • Explain why Cyanobacteria could not live without Light • Differentiate between different pigments in cyanobacteria 	
2.2.	<p>Psychomotor Skills</p> <ul style="list-style-type: none"> ❖ Upon successful completion of this course, the student is expected to be able to: <ul style="list-style-type: none"> • Preparation the suitable medium for isolation and cultivation of Cyanobacteria. • Preparation of cyanobacteria slides and investigation by microscope. • Perform the laboratory experiments precisely • Operate all devices in lab • Assemble and collect important samples for isolation of Cyanobacteria • Cultivate the Cyanobacteria isolates 	
3 Competence:		
3.1	<ul style="list-style-type: none"> ❖ Upon successful completion of this course, the student is expected to be able to: <ul style="list-style-type: none"> • Developing oral presentations. • Communicating personal ideas and thoughts. • Work independently and as part of a team to finish some assignments. • Communicate results of work to others. • Use of needed precautions when dealing with pathogen microorganisms • Demonstrate professional attitudes and behaviors towards others. • Propose the smart questions • Understand and dissecting the problem so that it is fully solved understood. • Demonstrate the assertiveness for his decision. • Demonstrate his capability for the responsibility and Accountability • Show Effective verbal communication with clarity and must be characterize with the following interpersonal attributes; (verbal communication, Non-verbal communication, good listening for the others, questioning, good manners, problem solving, Social awareness,self-management, responsibility and accountability) 	

CLOs		Aligned PLOs
	<ul style="list-style-type: none"> Enhancing the ability of students to use computers and internet. Interpret the laboratory data. Know how to write a report. 	

C. Course Content

1 Topics to be Covered		
Topic	No of Weeks	Contact hours
❖ A brief history about the cyanobacteria including: -Role of cyanobacteria in environment -Historical Taxonomy of cyanobacteria -Scientific terms in cyanobacteria -Similarities and differences between cyanobacteria, other groups of bacteria and algae -Economic importance of cyanobacteria	1	2
❖ General characteristics of cyanobacteria: -Cell structure of cyanobacteria -Pigments of cyanobacteria -Motility of cyanobacteria -Morphology of cyanobacteria	1	2
❖ Reproduction in cyanobacteria: -Vegetative reproduction (Binary fission, Fragmentation, Hormogonia) -Asexual reproduction (Endospores, Nanospores Naninocytes, Akinetes, Heterocyst) -Sexual Reproduction	1	6
❖ Taxonomy of cyanobacteria: - Nomenclature of cyanobacteria - Identification - Classification - Morphological characteristics - Phenotypic and Genotypic of cyanobacteria - Cyanobacteria taxonomy in Bergey's Manual of determinative Bacteriology -Cyanobacteria taxonomy in Bergey's Manual of Systematic Bacteriology		

<p>❖ Characteristics and taxonomy of cyanobacterial orders. In this section the students will be study the detailed about general characteristics and taxonomy of each order including the important families, genera and species related to each genus.</p> <ul style="list-style-type: none"> - Chroococcales : - Oscillatoriales - Nostocales - Stigonematales - Pleurocapsales - Rivulariales 	5	10
<p>❖ Metabolism in cyanobacteria:</p> <ul style="list-style-type: none"> - Important difination: (Metabolism, Catabolism, Anabolism) - Energy Metabolism in Cyanobacteria - Photosynthesis in cyanobacteria - The different between the photosynthesis in cyanobacteria (Oxygenic) and Anoxygenic phototrophic bacteria. - Respiratory metabolism in cyanobacteria - Chemotrophic synthesis in cyanobacteria. 	1	2
<p>❖ Biological nitrogen fixation in cyanobacteria</p> <ul style="list-style-type: none"> -Nitrogenase structure in cyanobacteria - Types of cyanobacteria capable to fix atmospheric nitrogen; -Filamentous forming heterocyst fixing nitrogen (<i>Nostoc</i>, <i>Anabaena</i>, <i>Tolypothrix</i>, <i>Calothrix</i>, <i>Aulosira</i>). -Non heterocyst Filamentous cyanobacteria fixing fitrogen (<i>Oscillatoria</i>, <i>Plectonema</i>, <i>Scytonema</i>) - Mono cells fixing nitrogen (<i>Gloeocapsa</i>) 	2	4
<p>❖ Factors effect on cyanobacteria</p> <ul style="list-style-type: none"> -Moisture, Oxygen, light, elements, vitamins requirements, Effect of herbicides and pesticides on cyanobacteria 	1	2
<p>❖ Toxins of cyanobacteria</p> <ul style="list-style-type: none"> -Structure of cyanotoxins -Common Cyanotoxins: (Hepatotoxin,Neurotoxin, Aplysiatoxin) -General diagnostics of cyanotoxins -Methods for determination of cyanotoxins 	2	4
	14 weeks	28hrs

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	<ul style="list-style-type: none"> List the role of cyanobacteria in the life and environment. Recognize and classify of cyanobacteria l genera Describe the structures of cyanobacteria. List the types of pigments in cyanobacteria Memorize the metabolism in cyanobacteria Write techniques for isolation and identification of cyanobacteria List the different order, families, genera and species of cyanobacteria Describe the general characteristics of cyanobacteria Describe the reproduction in cyanobacteria List the types of toxins produced from cyanobacteria Define the cyanotoxins and describe its properties. 	<p>The methodology includes a combination of lectures by the lecturer, seminar presentation by the students and web-interactions.</p> <ul style="list-style-type: none"> - Students will be given opportunity to understand the role of important cyanobacteria in the environment - At the end of the programme, students will be divided into groups for seminar presentation on important areas of the course to assess their understanding and comprehension of the course. - All students will be involved in on-line learning process and each student is required to create an E-mail address to facilitate student web interactions. <p>Using images and movies.</p> <ul style="list-style-type: none"> - Encouraging students to collect the new information about what the new cyanobacteria - Availability of the reference books and scientific sites concerning cyanobacteria in internet. 	<ul style="list-style-type: none"> Periodical exam and reports 10% Mid- term theoretical exam 20% Mid-term practical exam 5% Final practical exam 15% Final exam 50%

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0 Skills			
2.1	<p>Cognitive skills</p> <ul style="list-style-type: none"> • Explain the fine structure of cyanobacteria • Distinguish between the different genera of cyanobacteria. • Discuss mechanism of the nitrogen fixation on cyanobacteria • Interpret how cyanobacteria synthesis its energy. • Explain why cyanobacteria do not need sugar as carbon source in its metabolism. • Discuss the photosynthesis in Cyanobacteria. • Compare between the different Genera of Cyanobacteria. • Explain why Cyanobacteria could not live without Light • Differentiate between different pigments in cyanobacteria 	<ul style="list-style-type: none"> • Lectures • Brain storming • Discussion 	<ul style="list-style-type: none"> • Exam must contain questions that can measure these skills. • Quiz and exams • Discussions after the lecture.
2.2	<p>Psychomotor Skills</p> <ul style="list-style-type: none"> ❖ Upon successful completion of this course, the student is expected to be able to: <ul style="list-style-type: none"> • Preparation the suitable medium for isolation and cultivation of Cyanobacteria. • Preparation of cyanobacteria slides and investigation by microscope. • Perform the laboratory experiments precisely • Operate all devices in lab • Assemble and collect important samples for isolation of Cyanobacteria • Cultivate the Cyanobacteria isolates. 	<ul style="list-style-type: none"> - Follow up students the students in lab and during carryout all the laboratory experiments 	<ul style="list-style-type: none"> -Giving additional marks for the students they have accurate laboratory results and good seminar presentation -Practical exam.
3.0 Competence			
	<ul style="list-style-type: none"> • Developing oral presentations. • Communicating personal ideas and thoughts. • Work independently and as part of a team to finish some assignments. • Communicate results of work to others. 	<ul style="list-style-type: none"> - Lab work - Case Study - Active learning - Small group discussion - Homework (preparing a report on some topics related to the course depending on web 	<ul style="list-style-type: none"> - Oral exams. - Evaluate the efforts of each student in preparing the report. - Evaluate the scientific values of reports. - Evaluate the work in team

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	<ul style="list-style-type: none"> • Use of needed precautions when dealing with pathogen microorganisms • Demonstrate professional attitudes and behaviors towards others. • Propose the smart questions • Understand and dissecting the problem so that it is fully solved understood. • Demonstrate the assertiveness for his decision. • Demonstrate his capability for the responsibility and Accountability • Show Effective verbal communication with clarity and must be characterize with the following interpersonal attributes; (verbal communication, Non-verbal communication, good listening for the others, questioning, good manners, problem solving, Social awareness, self-management, responsibility and accountability) • Enhancing the ability of students to use computers and internet. • Interpret the laboratory data. • Know how to write a report. 	<ul style="list-style-type: none"> - sites). - Seminars presentation - Practical during carryout the experiments in the lab. 	<ul style="list-style-type: none"> - Evaluation of the role of each student in lab group assignment - Evaluation of students presentations

2. Assessment Tasks for Students

2. Assessment Tasks for Students

5. Schedule of Assessment Tasks for Students During the Semester

Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Exam duration	Proportion of Final Assessment
1	Periodical Exam (s)	4	15 min	10 %
2	Mid Term Exam (Theoretic)	8	60 min	20 %
3	Mid Term Exam (practical)	9	30 min	10 %
4	Reports and essay	11	--	5 %
5	Final Practical Exam	15	60 min	15 %
6	Final Exam	16	120 min	40 %
Total Marks				100%

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Office hours: 10hrs.

F. Learning Resources and Facilities

1. Learning Resources

<p>Required Textbooks</p>	<ul style="list-style-type: none"> • Course note and PPT prepared by faculty member responsible for the course: Associate Prof. Dr. Khaled Elbanna. -Book note prepared by prof. Dr. Khaled Jamlel The Biology of Cyanobacteria. N .G.Carr abd B.A.Whitton Blakwell (1982). -Brock Biology of Microorganisms, Twelfth edition by Madigan, Martinko, Dunlap and Clark; Publisher: Pearson Prentice-Hall, ISBN: 0132324601 (2008). •
<p>Essential References Materials</p>	<p>1-Prescott, L., Harley, J. and Klien, D. (2005). Microbiology, MacGraw 2-The Cyanobacteria . Rippka and others(1979) Generic Assignments , strain histories and properties of pure culture of cyanobacteria 3-Toxic cyanobacteria in Water . OChorus and Bartram(edts) 1999. 4-Introduction to the Cyanobacteria, University of California, Berkeley 2006.</p>
<p>Electronic Materials</p>	<p>WWW.Cyanosite.com WWW.Cyanonews.com</p>
<p>Other Learning Materials</p>	<ul style="list-style-type: none"> • PPT prepared by faculty member responsible for the course: Associate Prof. Dr. Khaled Elbanna.

2. Facilities Required

Item	Resources
<p>Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)</p>	<ul style="list-style-type: none"> • Class room is already provided with data show • The area of class room is suitable concerning the number of enrolled students (68) and air conditioned
<p>Technology Resources (AV, data show, Smart Board, software, etc.)</p>	<ul style="list-style-type: none"> • Digital lab containing 15 computers.
<p>Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)</p>	<ul style="list-style-type: none"> • Incubators, autoclaves, measuring equipment, water bath, digital balances, pH meters, safety facilities. • Availability of some reference bacterial strains • Availability all kits for identification of the microorganisms isolated from different habitats • Availability of VITEK device for rapid identification of microorganisms • All chemicals and reagents that needed • Availability all kits for identification of the

Item	Resources
	microorganisms isolated from different habitates

G. Course Quality Evaluation

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching <ul style="list-style-type: none"> • Questionaries • Open discussion in the class room at the end of the lectures.
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department <ul style="list-style-type: none"> • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Processes for Improvement of Teaching <ul style="list-style-type: none"> • Preparing the course as PPT. • Using scientific movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) <ul style="list-style-type: none"> • After the agreement of Department and Faculty administrations
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. <ul style="list-style-type: none"> • Periodical revision by Quality Assurance Units in the Department and institution

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

H. Specification Approval Data

Prepared by faculty staff: 1. Prof. Dr. Khaled Elbanna	Signature:
Date Report Completed: November 2019	
Revised by: 1. Dr. Khaled Elbanna 2. Dr. Hussein H. Abulreesh 3. Dr. Shady Elshahawy	Signature:
Date: November 2019	
Program Chair Dr. Hussein H. Abulreesh	Signature:
Dean	Signature:
Date:	