University of Anbar
جامعة الانبار

First Cycle – Bachelor's Degree (B.Sc.) - Biotechnology

بكالوريوس علوم - علم التقنيات الاحيائية

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by the program of Biotechnology to gain the Bachelor of Science degree. The program delivers (43) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظره عامه

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج التقنيات الاحيائية للحصول على درجة بكالوريوس العلوم. يقدم البرنامج (43) مادة دراسية، على سبيل المثال، مع (٦٠٠٠) إجمالي ساعات حمل الطالب و ٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
BioT-611	biotechnology1	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	94	106
Description			

Biotechnology-1- course

This course covered the basic concepts of biotechnology 1, which includes the exploitation of microorganism cells Industrial and environmental components and their components in the production of many vital compounds such as enzymes, proteins, hormones , antibiotics, organic acids and their use in the industrial and environmental fields, and work to improve the productivity of these vital compounds by applying all modern techniques of genetic engineering, as well as developing the use of these compounds in biosystems to treat polluted environments and improve nature through environmental waste treatment and fertilizer production vitality and biofuels within renewable energies.

Module 2

Code	Course/Module Title	ECTS	Semester
BioT-612	biology (plant)	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	4	94	106

Description

Botany, the scientific study of plants, encompasses a captivating world of intricate structures and fascinating life forms. Delving into the realm of descriptive botany unveils a tapestry of botanical wonders waiting to be explored. Through keen observation and meticulous documentation, botanists unravel the secrets of plant morphology, exposing the beauty and complexity hidden within nature's green realm.

In the realm of descriptive botany, every plant becomes a subject of scrutiny, its form and function dissected with scholarly precision. From the towering trees of ancient forests to the delicate blossoms adorning meadows, each plant presents an abundance of characteristics to be examined and unraveled.

With an artist's eye, descriptive botanists analyze the external features of plants, capturing the diversity of shapes, sizes, and textures. Leaves, adorned in a kaleidoscope of hues, reveal their distinctive arrangements, veination patterns, and margins. Petals, imbued with vibrant pigments, exhibit an array of shapes, from the delicate elegance of the lily to the intricate symmetry of the rose. Fruits, in their varied forms, beckon attention with colors that range from the vivid red of a ripe apple to the dusky purple of a juicy grape.

Yet, descriptive botany ventures beyond surface aesthetics, delving into the hidden recesses of plant anatomy. Under the microscope's watchful gaze, the intricacies of plant tissues and cells are unveiled. Thin sections reveal the intricate network of vascular tissues, transporting vital nutrients and water throughout the plant's architecture. Cells, the building blocks of life, come alive with organelles busily performing their metabolic symphonies, sustaining the plant's growth and survival.

Through careful comparison and classification, descriptive botany elucidates the relationships between plant species. It uncovers the shared heritage woven into the evolutionary tapestry of plants, as well as the unique adaptations that have allowed them to thrive in diverse environments. By

meticulously cataloging plant structures, botanists construct a roadmap of plant diversity, allowing us to navigate the rich tapestry of the botanical world.

Descriptive botany, a journey of meticulous observation and eloquent description, deepens our understanding of plants and their intricate mechanisms. It unveils the untold stories of the botanical realm, painting vivid pictures of nature's artistry. As we immerse ourselves in the world of descriptive botany, we unlock the door to a realm of wonder, where the beauty and complexity of plants converge, inspiring awe and nurturing our curiosity about the botanical wonders that surround us.

Module 3

Code	Course/Module Title	ECTS	Semester
BioT-613	biophysics	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	86
Description			

Biophysics is an interdisciplinary field that combines the principles and methods of physics with the study of biological systems. It seeks to understand and explain biological phenomena in terms of physical principles and laws.
Biophysicists apply the tools and techniques of physics, such as mathematics, statistics, thermodynamics, mechanics, optics, and spectroscopy, to investigate various aspects of living organisms at different scales, ranging from molecules and cells to tissues and whole organisms.
Some areas of study within biophysics include:

1. Molecular Biophysics: This field focuses on understanding the structure, dynamics, and interactions of biological macromolecules such as proteins, nucleic acids, and lipids. Techniques like X-ray crystallography, nuclear magnetic resonance (NMR), and molecular modeling are commonly used.
2. Cellular Biophysics: Cellular biophysics explores the physical properties of cells and cellular processes. It involves studying cellular structures, transport mechanisms, membrane biophysics, and cell signaling using techniques like microscopy, patch-clamping, and fluorescence resonance energy transfer (FRET).
3. Neurophysics: Neurophysics involves the study of the physical principles underlying the functioning of the nervous system. It investigates topics such as neural networks, neuronal signaling, information processing in the brain, and the physics of sensory systems.
4. Biomechanics: Biomechanics focuses on the application of mechanical principles to biological systems. It encompasses the study of forces and movements in organisms, including the mechanics of muscles, bones, joints, and the overall movement of organisms.
5. Biophysical Imaging: This field involves the development and application of imaging techniques to visualize biological structures and processes. Techniques like magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET), and optical imaging are used to obtain detailed information about living systems.
6. Systems Biology: Systems biology aims to understand complex biological systems by integrating experimental data with mathematical and computational models. It involves studying interactions and dynamics at the molecular, cellular, and organismal levels to gain insights into biological processes and functions.

Module 4

Code	Course/Module Title	ECTS	Semester
BioT-614	biostatistic	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	49	51
Description			
Biostatistics is the application of statistical techniques to scientific research in health-related fields, including medicine, biology, and public health, and the development of new tools to study these areas. Since the beginning of the twentieth century, the field of biostatistics has become an indispensable tool in improving health and reducing illness. Biostatisticians play essential roles in designing studies, analyzing data and creating methods to attack research problems as diverse as:-the determination of major risk factors for heart disease, lung disease and cancer, the testing of new drugs.			

Module 5

Code	Course/Module Title	ECTS	Semester
BioT-615	arabic language	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	62	38
Description			

وصف المقرر الدراسي للغة العربية يختلف بين المراحل التعليمية والأنظمة التعليمية المختلفة. ومع ذلك، سأقدم لك وصفًا عامًا للمقرر الدراسي للغة العربية في المدارس العامة:

1. القراءة والكتابة: يتضمن المقرر تعليم الطلاب قراءة النصوص باللغة العربية وفهمها، بالإضافة إلى تعلم مهارات الكتابة الصحيحة والتعبير بشكل متناسق وواضح.
2. القواعد والنحو: يشمل التركيز على قواعد اللغة العربية والنحو، مثل التصريف والإعراب والجمل والأفعال والأسماء. يتعلم الطلاب كيفية استخدام القواعد بشكل صحيح في بناء الجمل والتعبير بطريقة صحيحة.
3. الاستماع والمحادثة: يتضمن المقرر تدريب الطلاب على مهارات الاستماع والفهم اللغوي، بالإضافة إلى تعلم المحادثة العربية اليومية والقدرة على التواصل باللغة العربية في مواقف مختلفة.
4. الأدب والثقافة: يتعرف الطلاب على الأدب العربي والثقافة، ويدرسون الأعمال الأدبية الكلاسيكية والمعاصرة، مثل الشعر والرواية والمسرح. يتعرف الطلاب أيضًا على القيم والتقاليد والتاريخ الثقافي للعالم العربي.
5. الترجمة: قد يشمل المقرر دراسة مبادئ الترجمة، حيث يتعلم الطلاب كيفية ترجمة النصوص من اللغة العربية إلى لغات أخرى والعكس.

يهدف المقرر الدراسي للغة العربية إلى تعزيز مهارات الطلاب في استخدام اللغة العربية بطلاقة وفهم النصوص

Module 6

Code	Course/Module Title	ECTS	Semester

BioT-621	biotechnology2	8	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	4	94	106
Description			

Biotechnology-2 course

This course covered the basic concepts of biotechnology-2, which deals with how living cells can be exploited Industrial and environmental microspheres and their components in the production of many vital compounds such as enzymes, proteins, hormones, antibiotics, and organic acids and their use in industrial, environmental, and work fields. In addition to that, we aim to improve the productivity of these vital compounds by applying all modern techniques in genetic engineering. Developing the use of biological systems to treat polluted environments and improve nature through environmental waste treatment and the production of biofertilizers and biofuels within renewable energies.

Module 7

Code	Course/Module Title	ECTS	Semester
BioT-622	biology (animal)	8	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	4	94	106
Description			

An **animal cell** is the fundamental functional unit of life of animals. It is also the basic unit of reproduction. Animal cells were first observed in the 17th century when microscopy was invented. Robert Hooke, an English natural philosopher, was the first to describe microscopic pores, which he later called *cells*, albeit from samples of a plant cork. Anton van Leeuwenhoek, a Dutch scientist, was also able to observe cells under a microscope. Apart from the single-celled organisms, such as prokaryotic cells and protozoa, he was the first to describe red blood cellsAnimal cells are the basic structural and functional units of animal tissues and organs. They are eukaryotic cells. It means that, unlike prokaryotic cells, animal cells have membrane-bound organelles suspended in the cytoplasm enveloped by a plasma membrane. This fundamental feature is not exclusive to animal cells though. Both animal cells and plant cells are eukaryotes, and therefore a plant cell has this feature, too. However, plant cells can be easily distinguished from animal cells by the presence of a cell wall. Apart from this, an animal cell also lacks plastids, especially chloroplasts, that are involved in a plant's photosynthesis. typical structure of an animal cell includes organelles, cytoplasmic structures, cytosol, and cell membrane. Organelles are membrane-bound structures inside the cell and each of them has a distinctive role. Cytoplasmic structures are structures in the cytoplasm that are not bounded by membranes and yet have a crucial role in certain cellular activities.

Module 8

Code	Course/Module Title	ECTS	Semester

BioT-623	chemistry	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61

Description

Chemistry is the scientific discipline that focuses on the study of matter, its properties, composition, structure, and the changes it undergoes during chemical reactions. It plays a vital role in our understanding of the natural world and has applications in various fields such as medicine, industry, energy, and environmental science.

Here are some key areas of study within chemistry:

Organic Chemistry: This branch of chemistry deals with the study of carbon-based compounds. It involves the structure, properties, synthesis, and reactions of organic molecules, including hydrocarbons, polymers, carbohydrates, lipids, and proteins.

Inorganic Chemistry: Inorganic chemistry focuses on the study of elements and compounds that do not primarily contain carbon. It includes the properties, synthesis, and reactivity of inorganic compounds, such as metals, minerals, acids, bases, and coordination compounds.

Physical Chemistry: Physical chemistry combines principles of physics and chemistry to study the physical properties and behavior of matter. It involves topics such as thermodynamics, quantum mechanics, spectroscopy, kinetics, and statistical mechanics.

Analytical Chemistry: Analytical chemistry involves the identification, quantification, and analysis of chemical substances. It includes techniques and methods for separating, purifying, and measuring the components of a sample, such as chromatography, spectroscopy, and electrochemistry.

Biochemistry: Biochemistry focuses on the chemical processes and substances that occur within living organisms. It studies the structure and function of biological macromolecules (proteins, nucleic acids, carbohydrates, and lipids), enzymatic reactions, metabolism, and the biochemical basis of diseases.

Environmental Chemistry: Environmental chemistry examines the chemical processes and transformations that occur in the environment. It involves studying the sources, transport, fate, and effects of chemicals in ecosystems, as well as environmental pollution and remediation.

Chemistry is a highly experimental science, and laboratory work is an integral part of studying the subject. Students learn to conduct experiments, analyze data, and make observations to deepen their understanding of chemical concepts and principles.

Overall, chemistry provides a foundation for understanding the composition and behavior of matter, as well as its interactions and applications in various fields, making it a crucial discipline for scientific progress and technological advancements.

Module 9

Code	Course/Module Title	ECTS	Semester
BioT-624	computer	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

	2	32	43
Description			
Computer science is a field of study that encompasses the theory, design, development, and application of computer systems. It involves both the hardware and software aspects of computing, as well as the algorithms and principles that govern how computers operate and solve problems. Here are some key areas within computer science: Algorithms and Data Structures: Algorithms are step-by-step procedures used to solve problems and perform computations. Data structures refer to the organization and management of data in computer systems. Understanding algorithms and data structures is fundamental for efficient problem-solving and software development. Programming Languages: Programming languages are used to write software programs. Computer science involves learning various programming languages and understanding their syntax, semantics, and features. Common programming languages include Python, Java, C++, and JavaScript. Software Engineering: Software engineering focuses on the principles, methods, and tools used in the development and maintenance of high-quality software systems. It involves software design, coding, testing, and project management to ensure the effective and efficient creation of software products. Computer Architecture: Computer architecture deals with the design and organization of computer systems, including the structure of hardware components, memory systems, and input/output devices. It also involves studying topics like processors, instruction sets, and computer organization. Artificial Intelligence (AI) and Machine Learning: AI involves creating intelligent machines capable of performing tasks that typically require human intelligence. Machine learning is a subset of AI that focuses on developing algorithms and models that enable computers to learn from data and make predictions or decisions. Databases and Data Management: Databases are used to store and manage large amounts of structured data efficiently. This field involves designing and implementing database systems, data modeling, query languages (such as SQL), and data mining techniques for extracting meaningful insights from data. Networks and Security: Networking deals with the communication and interconnection of computer systems. It involves studying protocols, network design, and network security. Network security focuses on protecting computer networks from unauthorized access, attacks, and data breaches. Operating Systems: Operating systems are the software that manages computer hardware and software resources. Studying operating systems involves understanding process management, memory management, file systems, and device drivers. Computer science has a wide range of applications and is used in various industries, including software development, cybersecurity, data analysis, artificial intelligence, robotics, and computer graphics. It is a rapidly evolving field that drives technological advancements and innovation in our modern digital world.			

Module 10

Code	Course/Module Title	ECTS	Semester
BioT-625	english language	3	2

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	47	28

Description

The English language is a West Germanic language that originated in England and is now one of the most widely spoken languages in the world. It serves as a lingua franca for international communication and is an official or widely spoken language in many countries.

Here are some key aspects of the English language:

Vocabulary: English has a large vocabulary derived from various sources, including Germanic, Latin, French, and Greek. It consists of words, phrases, idioms, and expressions that are used to convey meaning and communicate effectively.

Grammar: English grammar involves the rules and structures that govern the formation of sentences and the arrangement of words. It includes elements such as nouns, verbs, adjectives, adverbs, pronouns, prepositions, conjunctions, and interjections.

Writing: English writing encompasses various forms, such as essays, reports, letters, articles, and creative writing. It involves organizing ideas coherently, using proper grammar and punctuation, and adapting the writing style to the intended audience.

Speaking and Listening: English speaking and listening skills are crucial for effective communication. This involves pronunciation, intonation, fluency, and the ability to understand and respond appropriately in conversations and discussions.

Reading and Comprehension: Reading in English involves understanding written texts, ranging from simple sentences to complex articles and literature. Comprehension skills include extracting meaning, making inferences, and analyzing the content.

Academic English: Academic English is a specific style of English used in educational and professional settings. It involves formal writing, research skills, critical thinking, and the ability to express complex ideas clearly and accurately.

Variations and Dialects: English has many regional variations and dialects, such as British English, American English, Australian English, and others. These variations may differ in pronunciation, vocabulary, grammar, and idiomatic expressions.

English as a Second Language (ESL): English is often learned as a second language by non-native speakers. ESL education focuses on teaching English language skills to individuals who use other languages as their primary means of communication.

English is widely used in fields like business, science, technology, academia, entertainment, and international relations. Proficiency in English offers numerous opportunities for personal, educational, and professional growth.

Learning English involves studying its vocabulary, grammar, pronunciation, and cultural aspects. Practice through reading, writing, listening, and speaking is crucial for developing language skills and becoming proficient in English.

Module 11

Code	Course/Module Title	ECTS	Semester
BioT-626	Human right and freedom and democracy	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	32	43
Description			
يعد فهم حقوق الإنسان والحرية والديمقراطية أمرًا ضروريًا لتعزيز العدالة والمساواة ورفاه الأفراد والمجتمعات. بينما يمكنني تقديم معلومات ورؤى حول هذه الموضوعات ، من المهم ملاحظة أن الوصف التالي ليس شاملاً ويجب استكماله بمزيد من البحث والدراسة. حقوق الإنسان: حقوق الإنسان متأصلة في جميع الأفراد ، بغض النظر عن الجنسية أو العرق أو الجنس أو الدين أو أي خصائص أخرى. وهي تشمل الحريات والاستحقاقات الأساسية التي يجب أن يتمتع بها كل شخص ، مثل الحق في الحياة والحرية والمساواة والكرامة والتحرر من التمييز. الحرية: تشير الحرية إلى قدرة الأفراد على ممارسة حقوقهم والقيام بالاختيارات دون قيود أو تدخلات لا داعي لها. وهي تشمل جوانب مختلفة ، بما في ذلك حرية الكلام ، وحرية التعبير ، وحرية التجمع ، وحرية الدين ، وحرية تكوين الجمعيات. الديمقراطية: الديمقراطية هي نظام حكم تناط فيه السلطة للشعب ، ويمارسها إما بشكل مباشر أو من خلال ممثلين منتخبين. سيادة القانون: سيادة القانون هي المبدأ القائل بأن جميع الأفراد والمؤسسات يخضعون للقانون ويخضعون للمساءلة أمامه. يضمن تطبيق القوانين بشكل متساو وعادل وشفاف ، بغض النظر عن وضع الشخص أو تأثيره. إن سيادة القانون أمر حيوي لحماية حقوق الإنسان ، ومنع إساءة استخدام السلطة ، وضمان مجتمع عادل ومنظم. المؤسسات والحوكمة: المؤسسات القوية وأنظمة الحكم الفعالة ضرورية لدعم حقوق الإنسان وتعزيز الديمقراطية. وهذا يشمل سلطة قضائية مستقلة ، ووسائل إعلام حرة ومسؤولة ، وهيئات حكومية خاضعة للمساءلة وشفافة ، ومجتمع مدني قوي. تلعب هذه المؤسسات دورًا حاسمًا في حماية حقوق الإنسان ، وتعزيز المبادئ الديمقراطية ، وتوفير الضوابط والتوازنات داخل المجتمع. التثقيف والتوعية: يتطلب تعزيز حقوق الإنسان والحرية والديمقراطية التثقيف والتوعية بين الأفراد والمجتمعات. يساعد التعليم الناس على فهم حقوقهم ، وتطوير مهارات التفكير النقدي ، والمشاركة بنشاط في العمليات الديمقراطية. كما أنه يعزز احترام التنوع والتسامح والتعاطف ، ويضع الأساس لمجتمعات شاملة وديمقراطية. التحديات والتقدم: بينما تم إحراز تقدم في النهوض بحقوق الإنسان والحرية والديمقراطية على الصعيد العالمي ، لا تزال هناك تحديات عديدة. تشمل هذه التحديات قضايا مثل عدم المساواة الاجتماعية ، والتمييز ، والرقابة ، والفساد ، والاستبداد ، وتهديدات الحريات الفردية.			

Module 12

Code	Course/Module Title	ECTS	Semester
BioT-631	Biochemistry1	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	96
Description			
Biochemistry is the study of the chemical processes and substances that occur within living organisms. It involves the study of the structure, function, and interactions of biological macromolecules such as proteins, nucleic acids, lipids, and carbohydrates. Biochemistry provides a fundamental understanding of how biological			

molecules function and interact, and how they are synthesized and degraded in living organisms.

In a typical biochemistry course, students will learn about the chemical structures and properties of biological molecules, as well as the metabolic pathways that these molecules participate in. They will also study enzyme kinetics, protein structure and function, and the regulation of gene expression.

Biochemistry is a key discipline in many areas of biology and medicine, and is essential for understanding the molecular basis of disease. It is also important for the development of new drugs and therapies, as well as for the design of new materials and technologies.

Module 13

Code	Course/Module Title	ECTS	Semester
BioT-632	Environmental Biotechnology	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	96
Description			

Environmental biotechnology is a branch of biotechnology that focuses on using biological processes and organisms to address environmental challenges and improve sustainability. It applies various biotechnological techniques to study, monitor, and remediate environmental issues and to develop eco-friendly solutions.

Here are some key areas within environmental biotechnology:

Bioremediation: Bioremediation involves the use of microorganisms, such as bacteria, fungi, and algae, to degrade or remove pollutants from the environment. These organisms can break down or transform contaminants into less harmful substances, thus aiding in the cleanup of contaminated soil, water, and air.

Bioaugmentation: Bioaugmentation is the process of introducing beneficial microorganisms or genetically engineered organisms into an environment to enhance natural biological processes. It is commonly used in wastewater treatment plants and polluted ecosystems to improve the degradation of pollutants.

Phytoremediation: Phytoremediation utilizes plants to remove, degrade, or stabilize contaminants from soil, water, or air. Certain plants can accumulate pollutants in their tissues, effectively cleaning up contaminated sites. Phytoremediation can be used in conjunction with other biotechnological approaches to enhance remediation efforts.

Biofuels and Bioenergy: Environmental biotechnology plays a significant role in the production of renewable energy sources. It involves the use of microorganisms or plant-derived biomass to generate biofuels, such as bioethanol, biodiesel, and biogas. These bioenergy sources provide sustainable alternatives to fossil fuels and help reduce greenhouse gas emissions.

Biodegradable Materials: Environmental biotechnology also contributes to the development of

biodegradable materials that can replace conventional plastics and reduce waste pollution. Researchers work on utilizing biopolymers derived from renewable sources, such as plant starch or bacterial fermentation, to create eco-friendly packaging, disposable products, and other materials.

Environmental Monitoring: Biotechnology tools and techniques are used for environmental monitoring and assessment. DNA-based technologies, such as DNA sequencing and genetic markers, enable the identification and monitoring of organisms in ecosystems. Biosensors and biomarkers help detect pollutants and monitor environmental changes, providing valuable data for conservation and management efforts.

Waste Management: Environmental biotechnology plays a role in waste management by developing methods to convert organic waste into valuable products. Through processes like anaerobic digestion, composting, and fermentation, organic waste can be transformed into biogas, fertilizers, or other useful byproducts.

The application of environmental biotechnology has the potential to contribute to sustainable development, pollution prevention, and ecosystem restoration. By harnessing the power of biological systems, it offers innovative and environmentally friendly solutions to address environmental challenges and promote a cleaner and healthier planet.

Module 14

Code	Course/Module Title	ECTS	Semester
BioT-633	Microbiology1	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	111
Description			

وصف مقرر الاحياء المجهرية المرحلة الثانية – قسم التقنيات الاحيائية – كلية العلوم – جامعة الانبار

هو العلم الذي يختص **(Microbiology :**بالإنجليزية**)** علم الأحياء الدقيقة، البيولوجيا الدقيقة، علم الميكروبات، أو الميكروبيولوجيا بدراسة الأحياء الدقيقة وحيدة الخلية ومتعددة الخلايا وكذلك عديمة النواة كالفيروسات بما فيها بعض حقيقيات النوى مثل الفطريات والأوليات إضافة إلى بدائيات النوى مثل البكتيريا وبعض الطحالب. علم الأحياء الدقيقة ما زال يعد في بداياته مقارنة بعلم الحيوان وعلم النبات وعلم الحشرات..

يستخدم علم الأحياء الدّقيقة (الميكروبيولوجيا) في شتى مناحي الحياة، مثل:

أساس علم الباثولوجيا (علم الأمراض).

استخدامات عسكرية استخدامات أمنية في مجال الأدلة الجنائية.

إجراء الفحوصات المخبرية للمياه والتربة والأغذية والمشروبات من أجل التأكد من صلاحيتها وخلوها من الميكروبات.

إنتاج واستحداث المضادّات الحيويّة.

صناعة وتطوير اللّقاحات.

بعض الصّناعات الغذائية.

الإلمام بهذا العلم يساعد على حماية الإنسان والنّبات والحيوان من أخطار هذه الكائنات الدّقيقة.

استخدام بعض الأنواع للقضاء على أنواع أخرى غير مرغوب فيها أو مسبّبة في أضرار للإنسان أو المحاصيل عن طريق المحاربة الهستونية.

تساعد علماء الهندسة الوراثيّة والتّعديل الجيني في فهم طبيعية الحمض النووي **RNA.** و **DNA**

تساعد علماء التّطور الطّبيعي في معرفة ومتابعة مسالك وطرق التّطور الّتي أخذتها الحياة على الأرض.

Module 15

Code	Course/Module Title	ECTS	Semester
BioT-634	Histological and Microscopic preparation	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	96

Description

Histological and microscopic preparation is a series of steps and techniques used to prepare biological samples, such as tissues or cells, for microscopic examination. These preparations aim to preserve the structure, morphology, and cellular components of the sample, allowing for detailed analysis and observation under a microscope. Here are the general steps involved in histological and microscopic preparation:

Tissue Sampling: A small piece of tissue is obtained from the organism or organ of interest. This can be done through biopsy, surgical excision, or tissue dissection.

Fixation: The tissue sample is immediately immersed in a fixative solution, such as formalin or paraformaldehyde. Fixation helps preserve the cellular structures, prevent decay, and maintain the tissue's integrity. The duration of fixation depends on the size and type of tissue, but it typically takes several hours to a few days.

Dehydration: After fixation, the tissue is dehydrated by passing it through a series of alcohol solutions of increasing concentration. Dehydration removes water from the tissue and replaces it with alcohol, preparing it for embedding in a solid medium.

Clearing: To remove the alcohol and make the tissue transparent, it is immersed in a clearing agent, such as xylene or toluene. Clearing agents dissolve the alcohol and prepare the tissue for infiltration with an embedding medium.

Embedding: The dehydrated and cleared tissue is infiltrated with an embedding medium, commonly paraffin wax or resin. The tissue is placed in molds or cassettes and surrounded by the molten embedding medium, which solidifies as it cools. This step provides support and facilitates sectioning of the tissue.

Sectioning: The embedded tissue block is trimmed and cut into thin slices, typically 4-10 micrometers thick, using a microtome. The microtome allows precise sectioning and produces thin tissue sections that can be mounted on glass slides for microscopic examination.

Staining: Tissue sections are usually stained to enhance contrast and highlight specific cellular components or structures. Common staining methods include hematoxylin and eosin (H&E), which provides general tissue morphology, and specialized stains for specific components like nuclei, cytoplasm, or connective tissue.

Mounting: Stained tissue sections are mounted onto glass slides using a mounting medium, such as Canada balsam or synthetic resins. The mounting medium provides transparency and preserves the stained tissue for long-term storage.

Coverslipping: A coverslip, a thin piece of glass or plastic, is placed over the mounted tissue section using a mounting medium, such as mounting media or adhesive. Coverslipping protects the tissue and prevents damage during microscopy.

Microscopic Examination: Prepared tissue sections are ready for microscopic examination. They can be

observed under a light microscope or other specialized microscopes, allowing for the analysis of tissue structure, cell types, and other morphological features.

Histological and microscopic preparation techniques are essential in various scientific fields, including medicine, pathology, biology, and research. These preparations enable researchers, pathologists, and scientists to study tissue architecture, identify abnormalities, diagnose diseases, and gain insights into the cellular and structural characteristics of biological specimens.

Module 16

Code	Course/Module Title	ECTS	Semester
BioT-635	Biosafety	2	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2		32	18

Description

Biosafety refers to the principles, practices, and measures implemented to ensure the safe handling, containment, and disposal of biological materials to protect the health and well-being of humans, animals, and the environment. Biosafety is crucial in laboratories, research facilities, healthcare settings, and other environments where biological agents are handled, manipulated, or studied. Here are some key aspects of biosafety:

Risk Assessment: Before working with biological agents, a thorough risk assessment is conducted to identify potential hazards and evaluate the associated risks. This assessment considers the characteristics of the biological agent, the procedures involved, and the potential for exposure or release into the environment.

Containment Levels: Biosafety practices are categorized into containment levels based on the degree of risk associated with the biological agents being handled. The World Health Organization (WHO) and other organizations have established guidelines, such as Biosafety Levels 1 to 4, which outline the specific requirements for each containment level, including facility design, equipment, personal protective equipment (PPE), and procedures.

Engineering Controls: Biosafety measures often include the use of engineering controls to minimize the risk of exposure to biological agents. These controls may include the installation of biological safety cabinets, fume hoods, glove boxes, and other equipment that provide physical containment and filtration systems to prevent the release of airborne contaminants.

Personal Protective Equipment (PPE): Proper use of PPE is essential in biosafety practices. PPE includes items such as gloves, lab coats, face masks, goggles, and respirators. The selection and use of appropriate PPE depend on the specific hazards and risks associated with the biological agents and procedures being performed.

Standard Operating Procedures (SOPs): SOPs are established to provide step-by-step instructions for safe handling, storage, and disposal of biological materials. These procedures outline the specific protocols, techniques, and precautions to be followed to minimize the risk of exposure and ensure consistent and safe practices.

Training and Education: Proper training and education are crucial for individuals working with biological agents. Training programs provide knowledge and understanding of biosafety principles, procedures, and

best practices. It helps individuals develop skills in risk assessment, proper handling techniques, emergency response, and waste management.

Waste Management: Proper disposal of biological waste is an essential aspect of biosafety. Biological waste, such as cultures, contaminated materials, and sharps, should be segregated, contained, and disposed of following specific guidelines and regulations. Autoclaving, incineration, or chemical treatments may be used to inactivate or sterilize biological waste before disposal.

Incident Response and Emergency Preparedness: Biosafety programs include plans for incident response and emergency preparedness. These plans outline procedures to be followed in the event of spills, accidents, exposures, or other incidents. They include protocols for containment, decontamination, and reporting of incidents, as well as provisions for medical surveillance and treatment, if necessary.

Biosafety is an integral part of ensuring the responsible handling and use of biological agents. Adhering to biosafety practices helps protect laboratory personnel, researchers, healthcare workers, and the broader community from potential risks associated with biological materials. It also helps prevent the accidental release of harmful agents into the environment and contributes to the safe advancement of scientific research and applications involving biological agents.

Module 17

Code	Course/Module Title	ECTS	Semester
BioT-641	Biochemistry2	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71
Description			

Biochemistry is the study of the chemical processes and substances that occur within living organisms. It involves the study of the structure, function, and interactions of biological macromolecules such as proteins, nucleic acids, lipids, and carbohydrates. Biochemistry provides a fundamental understanding of how biological molecules function and interact, and how they are synthesized and degraded in living organisms.

In a typical biochemistry course, students will learn about the chemical structures and properties of biological molecules, as well as the metabolic pathways that these molecules participate in. They will also study enzyme kinetics, protein structure and function, and the regulation of gene expression.

Biochemistry is a key discipline in many areas of biology and medicine, and is essential for understanding the molecular basis of disease. It is also important for the development of new drugs and therapies, as well as for the design of new materials and technologies.

Module 18

Code	Course/Module Title	ECTS	Semester

BioT-642	Microbial physiology	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	86
Description			
وصف مقرر فسلجة الاحياء المجهرية المرحلة الثانية – قسم التقنيات الاحيائية – كلية العلوم – جامعة الانبار تعريف الطلبة على مبادى علم الفسلجة بالاحياء المجهرية وذلك بدراسة طرق التغذية ومتطلباتها وتنمية الاحياء المجهرية خارج الجسم الحي والعوامل التي توثر على النمو واهم التفاعلات التي تحصل بواسطتها الاحياء المجهرية على الطاقة وكيفية استغلال هذه الطاقة في عمليات تخليق اجزاء الخلية وتراكيبها هنالك بعض الجوانب الفسلجية مثل تأثير العوامل الفيزيائية والكيميائية على الاحياء المجهرية او عملية تكوين السبورات من قبل بعض الأنواع.			

Module 19

Code	Course/Module Title	ECTS	Semester
BioT-643	Medical microbilogy	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2		79	71
Description			
Medical microbiology lectures are educational sessions that cover medical microbiology topics related to bacteria, viruses, parasites, diseases that cuased by theses medical microbiology, and virulence factors. These lectures are typically given by experts in the field of medical microbiology, and are attended by healthcare professionals, researchers, and students. medical microbiology lectures may cover a wide range of topics, including the different classes of viruses agents, the development of new medical microbiology drugs, strategies for understanding medical microbiologydealing, virulence factors, and the impact of antimicrobial resistance on healthcare. These lectures are an important tool for keeping healthcare professionals up-to-date on the latest advances in medical microbiology therapy and providing them with the knowledge and skills needed to make informed decisions about prescribing medical microbiology. biological processes and for developing new drugs and therapies for diseases. These techniques are used in a wide range of scientific fields, including biochemistry, molecular biology, genetics, and biotechnology.			

Module 20

Code	Course/Module Title	ECTS	Semester
BioT-644	General genetics	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71

Description

General Genetics

General genetics is a fundamental module that provides an introduction to the principles and concepts of genetics, the study of heredity and variation in living organisms. It covers the basic principles of inheritance, the structure and function of genes, and the mechanisms of genetic variation. The module aims to provide students with a solid foundation in genetics and an understanding of how genetic information is passed from one generation to the next.

The module description of general genetics typically includes the following key areas:

1. Mendelian genetics: This aspect focuses on the fundamental principles of inheritance as described by Gregor Mendel. It covers topics such as the laws of segregation and independent assortment, Punnett squares, and the determination of phenotypic ratios in monohybrid and dihybrid crosses. Mendelian genetics serves as the basis for understanding patterns of inheritance in organisms.

2. Chromosomal basis of inheritance: This part explores the relationship between genes and chromosomes. It covers topics such as chromosomal structure, gene mapping, sex determination, and sex-linked inheritance. Students learn about the role of chromosomes in transmitting genetic information and the impact of chromosomal abnormalities on inheritance patterns.

3. Molecular genetics: Molecular genetics delves into the structure and function of genes at the molecular level. It covers topics such as DNA structure, DNA replication, transcription, and translation. Students gain an understanding of how genetic information is stored, copied, and expressed to produce proteins. The module may also introduce basic concepts of gene regulation and gene expression.

4. Non-Mendelian inheritance: This aspect explores patterns of inheritance that deviate from Mendelian principles. Topics may include incomplete dominance, codominance, multiple alleles, polygenic inheritance, and epistasis. Students learn about the complexities of inheritance patterns and how they contribute to the diversity of traits observed in populations.

5. Genetic variation and evolution: This part covers the mechanisms that generate genetic variation within populations, including mutation, recombination, and gene flow. It explores how genetic variation provides the raw material for natural selection and drives evolutionary processes. Students gain insights into how genetic variation contributes to the adaptation and evolution of organisms over time.

6. Human genetics and genetic disorders: The module may include a section dedicated to human genetics, discussing topics such as pedigree analysis, genetic counseling, and the inheritance of genetic disorders. Students learn about the principles and methods used in human genetics research and gain an understanding of the genetic basis of various human diseases.

7. Ethical and social implications: This aspect explores the ethical, legal, and social implications of genetics. It covers topics such as genetic testing, genetic engineering, genetic discrimination, and the impact of genetics on personal and societal levels. Students engage in discussions regarding the ethical challenges associated with the use and application of genetic knowledge.

Overall, the general genetics module provides a comprehensive introduction to the fundamental concepts of genetics, equipping students with a solid understanding of inheritance patterns, molecular

mechanisms, genetic variation, and their applications. It serves as a foundation for more advanced studies in genetics and related disciplines.

Module 21

Code	Course/Module Title	ECTS	Semester
BioT-645	Biological control	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71

Description

Biological control, also known as biocontrol, is a method of managing pests, diseases, and invasive species using natural organisms to suppress or reduce their populations. It involves the use of living organisms, such as predators, parasites, pathogens, or competitors, to control the target organism or species. Biological control offers an environmentally friendly and sustainable alternative to chemical pesticides and other conventional control methods. Here are some key aspects of biological control:

Natural Enemies: Biological control relies on the identification and utilization of natural enemies that naturally occur in the ecosystem and have the ability to regulate pest populations. These natural enemies can be predators, such as insects, mites, or birds, that feed on the pest organisms, or parasites and pathogens that attack and kill the pests.

Pest and Host Specificity: Effective biological control agents are typically specific to their target pests or host species, meaning they primarily target and impact the desired organism without harming beneficial organisms or causing significant ecological disruption. This specificity is crucial to maintain the balance of the ecosystem and minimize unintended consequences.

Mass Rearing and Release: In some cases, biological control agents may be mass-reared in laboratory or production facilities and then released into the target environment at appropriate times. The release of these natural enemies aims to increase their population and enhance their impact on the target pest.

Augmentation and Conservation: Biological control can involve both augmentation and conservation approaches. Augmentation involves introducing additional natural enemies into the environment to supplement existing populations. Conservation focuses on preserving and enhancing the existing populations of natural enemies by creating suitable habitats, minimizing pesticide use, and implementing practices that support their survival and reproduction.

Integrated Pest Management (IPM): Biological control is often used as part of an integrated pest management approach, which combines various pest control methods, including biological, chemical, cultural, and physical controls. Integrated pest management aims to optimize pest control while minimizing negative impacts on human health and the environment.

Research and Monitoring: Effective implementation of biological control requires ongoing research and monitoring. Research is conducted to identify and evaluate potential natural enemies, understand their interactions with pests and the environment, and improve rearing and release techniques. Monitoring involves assessing pest populations, natural enemy populations, and the overall impact of biological control measures to make informed management decisions.

Success and Limitations: Biological control has been successfully used in various agricultural,

horticultural, and forestry systems to manage pests and invasive species. Examples include the use of ladybugs to control aphids, nematodes to manage soil-borne pests, and bacteria or viruses to control insect pests. However, the success of biological control can vary depending on factors such as the target pest species, environmental conditions, and the availability and effectiveness of suitable natural enemies.

Biological control is a valuable tool in integrated pest management and sustainable agriculture. It offers an alternative approach to chemical pesticides, reduces reliance on synthetic inputs, and contributes to the conservation of biodiversity and ecosystem health. However, it is important to carefully consider the specific context, target organism, and available biological control options when implementing a biological control program.

Module 22

Code	Course/Module Title	ECTS	Semester
BioT-651	Molecular biology	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71
Description			

The molecular biology session is a scientific gathering focused on the study of biological processes at the molecular level. It typically brings together researchers, scientists, and students with an interest in molecular biology to share and discuss the latest advancements in the field.

The session usually starts with an introduction to molecular biology, providing an overview of the fundamental principles and techniques used in this discipline. This may include topics such as DNA structure and replication, RNA transcription and translation, and protein synthesis. It sets the foundation for understanding the subsequent discussions.

The session then delves into specific research areas within molecular biology. This can cover a wide range of topics, depending on the focus and theme of the session. Some common areas of discussion may include:

Gene expression and regulation: Understanding how genes are turned on or off and how their expression is regulated in different cellular contexts.

Molecular genetics: Investigating the structure, function, and organization of genes, as well as studying genetic variation and its impact on phenotypes.

DNA sequencing and genomics: Exploring the methods and technologies used to determine the nucleotide sequence of DNA and analyzing large-scale genomic data.

RNA biology: Examining the roles and functions of different types of RNA molecules, such as messenger RNA (mRNA), ribosomal RNA (rRNA), and non-coding RNA, in gene expression and cellular processes.

Proteomics and protein structure: Studying the structure, function, and interactions of proteins, as well as analyzing their abundance and modifications in a given biological system.

Molecular mechanisms of disease: Investigating the molecular basis of various diseases, including cancer, genetic disorders, and infectious diseases, to gain insights into their causes and potential treatments.

Throughout the session, presenters may share their research findings through oral presentations, poster sessions, or both. This allows participants to learn about the latest discoveries, experimental techniques, and methodologies employed in molecular biology research.

Q&A sessions and discussions are typically included to encourage interaction and collaboration among attendees. This provides an opportunity for participants to ask questions, exchange ideas, and engage in scientific discourse to deepen their understanding of the topics presented.

Overall, the molecular biology session aims to foster scientific exchange, promote interdisciplinary collaborations, and advance our knowledge of the molecular mechanisms underlying various biological processes. It serves as a platform for researchers to share their work, learn from others, and collectively contribute to the field of molecular biology.

Module 23

Code	Course/Module Title	ECTS	Semester
BioT-652	Virology	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71
Description			
Virology lectures are educational sessions that cover various topics related to viruses structure, their life cycle, diseases that caused by these viruses, and symmetry. These lectures are typically given by experts in the field of virology or microbiology, and are attended by healthcare professionals, researchers, and students. Virology lectures may cover a wide range of topics, including the different classes of virus's agents, the development of new virus's drugs, strategies for understanding viruses dealing, and the impact of antivirus resistance on healthcare. These lectures are an important tool for keeping healthcare professionals up-to-date on the latest advances in virology therapy and providing them with the knowledge and skills needed to make informed decisions about prescribing viruses diseases.			

Module 24

Code	Course/Module Title	ECTS	Semester
BioT-653	Animal physilogy	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71
Description			
يمكن تعريف علم الوظائف الفسيولوجي:- بأنه ذلك الفرع من العلوم الحيوية الذي يتعامل مع الوظائف الكاملة للأعضاء المختلفة للجسم وهي بكامل صحتها ويؤكد على التغيرات التي تطرأ على الجسم بأكمله عند نشاط وعمل هذه الأعضاء أثناء قيامها بفعالياتها الأساسية والتحري عن سبب وكيفية أنجاز تلك الوظائف الحيوية الضرورية الدامة حياة الكائن الحي . أما أبسط تعريف يمكن أن ينطبق على الفسلجة :- هو علم وظائف الكائنات الحية . يختص علم الفسلة بدراسة كيفية عمل الجسم , ويعني علم الفسلجة			

بالمملكتين الحيوانية والنباتية غير أننا سنقتصر على المملكة الحيوانية . يبحث علم الفسلجة في فعاليات المادة الحية سواء على مستوى الكائن الحي بأكمله أو عضو منه أو على مستوى الخلية أو جزء منها , والهدف من علم الفسلجة هو فهم معنى الحياة. يعد علم الفسيولوجيا أحد الفروع الهامة لعلم البيولوجي الذي يهتم بدراسة ظاهرة الحياة في الكائنات الحية بصورة عامة , فالكائن الحي عبارة عن وحدة بيولوجية أي وحدة بنائية متكاملة مترابطة تتفاعل مكوناتها لتعطي ظاهرة الحياة للكائن الحي((. وعلم الفسيولوجي))هو العلم الذي يهتم بدراسة كيفية حدوث وظائف الكائن الحي المختلفة مثل عمل جهاز الدوران , جهاز التنفس , الجهاز العضلي , الغدد الصم... وهذا يعني : -وصف وظائف الأعضاء في الكائنات الحية الإنسان , الحيوان , النبات . -شرح وتفسير هذه الوظائف في ضوء القوانين الفيزيائية والكيميائية . وعليه يمكن تفسير علم الفسيولوجي في ضوء ما تقدم بأنه فيزياء وكيمياء الكائنات الحية , وليقتصر أن نعرف ما هي وظيفة هذا العضو أو ذاك , فأن هذا الوصف غير كافي ولكن الأهم أن نفسر كيف يؤدي ذلك العضو تلك الوظيفة ونحاول اكتشاف آلية هذه الوظيفة فضال عن دراسة العالقة بين أنشطة أعضاء الكائن الحي والعوامل التي تؤثر على هذه الأنشطة إذ يعتمد علم الفسيولوجي على الجوانب الفيزيائية والكيميائية والحيوية بالجسم .

Module 25

Code	Course/Module Title	ECTS	Semester
BioT-654	Elective course1	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 26

Code	Course/Module Title	ECTS	Semester
BioT-655	Biochemical techniques	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71
Description			
Biochemical techniques refer to a wide range of experimental methods used to study the chemical and physical properties of biological molecules such as proteins, nucleic acids, and carbohydrates. These techniques involve the use of various instruments and reagents to isolate, purify, and analyze the structure, function, and interactions of biological molecules. The techniques employed in biochemistry include protein purification, enzymology, electrophoresis, chromatography, mass spectrometry, and spectroscopic methods such as UV-Vis, fluorescence, and circular dichroism. Biochemical techniques are essential for understanding the complex molecular mechanisms that underlie biological processes and for developing new drugs and therapies for diseases. These techniques are used in a wide range of scientific fields, including biochemistry, molecular biology, genetics, and biotechnology. The development of new and improved biochemical techniques is critical for advancing our understanding of biological systems and for discovering new approaches to prevent and treat disease.			

Module 27

Code	Course/Module Title	ECTS	Semester
BioT-661	Microbial genetics	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46

Description

Microbial Genetics

Microbial genetics is a field of study that focuses on the genetic makeup, inheritance, and variation of microorganisms, particularly bacteria and viruses. It involves investigating the structure, function, and regulation of genes within microbial genomes, as well as the mechanisms of gene transfer and genetic recombination.

Microorganisms, including bacteria and viruses, have compact genomes that are relatively small in size compared to those of higher organisms. This characteristic makes them ideal for studying genetics as their genomes can be more easily sequenced and manipulated.

The module of microbial genetics typically covers several key areas:

1. Genome structure and organization: Microbial genetics explores the structure of microbial genomes, including the arrangement of genes, the presence of non-coding regions, and the identification of regulatory sequences. It also investigates the organization of genetic material, such as plasmids, transposons, and bacteriophages, within microbial cells.

2. Gene expression and regulation: This aspect involves studying how microbial genes are transcribed and translated into functional proteins. It examines the regulation of gene expression through mechanisms like operons, transcription factors, and epigenetic modifications. Understanding gene regulation is crucial for comprehending how microorganisms respond to environmental cues and adapt to different conditions.

3. Mutations and genetic variation: Microbial genetics explores the processes of genetic mutations and the resulting genetic variation within microbial populations. It investigates the mechanisms by which mutations occur, such as spontaneous mutations, mutagens, and DNA repair systems. Additionally, the study of genetic variation helps explain the evolution of microorganisms and their adaptation to changing environments.

4. Horizontal gene transfer: Microbes have unique capabilities for transferring genetic material horizontally between individuals or even different species. This module explores mechanisms such as conjugation, transformation, and transduction, which facilitate the exchange of genes between microorganisms. Horizontal gene transfer plays a significant role in the spread of antibiotic resistance, virulence factors, and other beneficial traits among microbial populations.

5. Applied aspects of microbial genetics: Microbial genetics has practical applications in fields like biotechnology, medicine, and environmental science. This module may cover topics such as the use of genetically modified microorganisms in bioprocessing, the development of recombinant DNA technologies, genetic engineering of bacteria for the production of therapeutic proteins, and the study of microbial communities in various ecosystems.

Overall, microbial genetics provides a foundation for understanding the genetic principles underlying

microbial life. It helps unravel the molecular mechanisms driving microbial behavior, evolution, and interactions, and has broad applications in diverse scientific and industrial disciplines.

Module 28

Code	Course/Module Title	ECTS	Semester
BioT-662	Immunology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
Immunology is the study of the immune system and is a very important branch of the medical and biological sciences. The immune system protects us from infection through various lines of defence. If the immune system is not functioning as it should, it can result in disease, such as autoimmunity, allergy and cancer. It is also now becoming clear that immune responses contribute to the development of many common disorders not traditionally viewed as immunologic, including metabolic, cardiovascular, and neurodegenerative conditions such as Alzheimer's. From Edward Jenner's pioneering work in the 18th Century that would ultimately lead to vaccination in its modern form (an innovation that has likely saved more lives than any other medical advance), to the many scientific breakthroughs in the 19th and 20th centuries that would lead to, amongst other things, safe organ transplantation, the identification of blood groups, and the now ubiquitous use of monoclonal antibodies throughout science and healthcare, immunology has changed the face of modern medicine. Immunological research continues to extend horizons in our understanding of how to treat significant health issues, with ongoing research efforts in immunotherapy, autoimmune diseases, and vaccines for emerging pathogens, such as Ebola. Advancing our understanding of basic immunology is essential for clinical and commercial application and has facilitated the discovery of new diagnostics and treatments to manage a wide array of diseases. In addition to the above, coupled with advancing technology, immunological research has provided critically important research techniques and tools, such as flow cytometry and antibody technology. An immunologist is a scientist and/or clinician who specialises in immunology. Many immunologists work in a laboratory focusing on research, either in academia or private industry (e.g. in the pharmaceutical industry). Other immunologists – "clinical immunologists" – are clinicians who focus on the diagnosis and management of diseases of the immune system, such as autoimmune diseases and allergies			

Module 29

Code	Course/Module Title	ECTS	Semester
BioT-663	Mycology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			

Module 30

Code	Course/Module Title	ECTS	Semester

BioT-664	Plant physiology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
Plant physiology is a subdiscipline of botany concerned with the functioning, or physiology, of plants. Closely related fields include plant morphology (structure of plants), plant ecology (interactions with the environment), phytochemistry (biochemistry of plants), cell biology, genetics, biophysics and molecular biology.Fundamental processes such as photosynthesis, respiration, plant nutrition, plant hormone functions, tropisms, nastic movements, photoperiodism, photomorphogenesis, circadian rhythms, environmental stress physiology, seed germination, dormancy and stomata function and transpiration, both parts of plant water relations, are studied by plant physiologists.			

Module 31

Code	**Course/Module Title**	**ECTS**	**Semester**
BioT-665	Elective course2	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	79	46
Description			
This section includes a description of the module, 100-150 words			

Module 32

Code	**Course/Module Title**	**ECTS**	**Semester**
BioT-666	Fermentation technology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	79	46
Description			
Fermentation technology course This course covered the concepts of fermentation techniques, which includes the exploitation of industrial microorganism cells, and the environment and its components in the production of many vital compounds such as enzymes, proteins, hormones, antibodies life, and organic acids and their use in the industrial and environmental fields, and work to improve the productivity of these biological compounds by applying all modern techniques of genetic engineering, as well as developing the use of systems to treat polluted environments and improve nature by treating environmental waste and producing biofertilizers. Biofuels are among renewable energies.			

Module 33

Code	Course/Module Title	ECTS	Semester
BioT-671	Animal tissue culture	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61

Description

Animal Tissue Culture

Animal tissue culture is a discipline within the field of cell biology that involves the cultivation and manipulation of animal cells in vitro (in a controlled laboratory environment). It focuses on the growth, maintenance, and study of animal cells outside of their natural context, allowing researchers to investigate various aspects of cell biology, physiology, and disease.

The module of animal tissue culture typically covers the following key areas:

1. Cell culture techniques: This aspect introduces the fundamental techniques and principles of animal cell culture. It includes topics such as cell isolation, cell culture media, aseptic techniques, cell line establishment, and culture maintenance. Students learn how to handle and manipulate animal cells in a controlled environment while maintaining their viability and specific characteristics.

2. Cell culture systems: Animal tissue culture explores different types of cell culture systems, such as monolayer cultures, suspension cultures, and three-dimensional (3D) cultures. Monolayer cultures involve growing cells as a single layer on a solid surface, while suspension cultures allow cells to grow freely in a liquid medium. 3D cultures aim to mimic the complexity of tissues by creating cell aggregates or scaffolds to support cell growth.

3. Cell line characterization: This aspect focuses on the characterization of cell lines derived from animal tissues. It covers techniques such as karyotyping, isoenzyme analysis, DNA fingerprinting, and other methods used to authenticate and validate cell lines. Understanding the characteristics and properties of cell lines is important for ensuring reliable and reproducible research results.

4. Cell proliferation and differentiation: Animal tissue culture investigates the factors that influence cell proliferation and differentiation. It explores the role of growth factors, hormones, cytokines, and other signaling molecules in controlling cell growth and fate determination. This knowledge is vital for studying developmental biology, stem cell research, and tissue engineering.

5. Cell culture applications: This module explores the wide range of applications of animal tissue culture. It covers areas such as drug discovery, toxicology studies, vaccine production, biomedical research, and regenerative medicine. Animal tissue culture serves as a valuable tool for studying the mechanisms of diseases, testing the efficacy and safety of potential therapeutics, and developing tissue-engineered constructs for transplantation.

6. Cell culture techniques and technologies: The module may also introduce advanced techniques and technologies used in animal tissue culture. These can include gene editing technologies like CRISPR-Cas9, co-culture systems, co-culture with extracellular matrix components, and the use of specialized culture vessels and bioreactors. The aim is to provide students with a comprehensive understanding of the latest tools and methods in the field.

Overall, animal tissue culture enables scientists to study and manipulate animal cells in a controlled environment, providing valuable insights into cell behavior, disease mechanisms, and potential therapeutic approaches. It forms a foundation for numerous biomedical and biotechnological applications and plays a crucial role in advancing our understanding of cellular biology.

Module 34

Code	Course/Module Title	ECTS	Semester
BioT-672	Genetic engineering and application	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46

Description

Genetic Engineering

Genetic engineering is a branch of biotechnology that involves the manipulation and modification of an organism's genetic material, typically its DNA (deoxyribonucleic acid). This field of study enables scientists to introduce, delete, or alter specific genes within an organism's genome, allowing them to change or enhance its characteristics or traits.

The primary goal of genetic engineering is to transfer desirable traits from one organism to another or to modify existing traits within an organism. This is achieved by isolating and manipulating specific genes responsible for those traits and introducing them into the target organism's genome. The genes can come from the same species or even from different species.

Genetic engineering techniques rely on various tools and methods, such as gene cloning, gene insertion, gene knockout, and gene editing technologies like CRISPR-Cas9. These tools enable scientists to modify the genetic information of an organism precisely.

The applications of genetic engineering are broad and diverse. It has revolutionized fields such as agriculture, medicine, and industry. In agriculture, genetically engineered crops are developed to exhibit desirable traits such as increased yield, resistance to pests or diseases, or improved nutritional content. In medicine, genetic engineering plays a crucial role in the production of recombinant proteins, development of gene therapies, and the study of genetic diseases. Industrial applications include the production of biofuels, enzymes, and other bio-based products.

However, genetic engineering also raises ethical, social, and environmental concerns. These include the potential risks associated with releasing genetically modified organisms into the environment, concerns about unintended consequences or unforeseen effects, and debates regarding the ethical boundaries of manipulating living organisms.

In summary, genetic engineering involves the deliberate modification of an organism's genetic material to achieve desired traits or outcomes. It has immense potential for improving various aspects of human life but also requires careful consideration of its implications and responsible use.

Module 35

Code	Course/Module Title	ECTS	Semester
BioT-673	Food Microbiology	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
وصف مقرر الاحياء المجهرية الغذائية المرحلة الرابعة – قسم التقنيات الاحيائية – كلية العلوم – جامعة الانبار علم الأحياء الدقيقة الغذائي (أو ميكروبيولوجيا الغذاء) هو دراسة الأحياء الدقيقة التي تسكن وتصنع أو تلّوث الغذاء. من الأهمية بمكان دراسة الكائنات المجهرية التي تتسبب في تلف المواد الغذائية؛ ومع ذلك فإن أهمية البكتيريا «النافعة» مثل البروبايوتكس تتزايد في علم الغذاء. إضافة إلى ذلك، فهذه الكائنات المجهرية ضرورية لإنتاج الغذاء مثل الجبن واللبن (probiotics :بالإنجليزية) الرائب وأنواع الغذاء المتخمّر الأخرى والخبز والبيرة والنبيذ. سلامة الغذاء هي محل تركيز أساسي في علم أحياء الغذاء؛ فالبكتيريا والفيروسات والسموم المسببة للمرض والتي تنتجها الأحياء الدقيقة هي كلها ملّوثات محتملة للغذاء. غير أنه من الممكن استغلال الأحياء الدقيقة ومنتجاتها أيضا لمحاربة هذه الميكروبات المسببة للأمراض			

Module 36

Code	Course/Module Title	ECTS	Semester
BioT-674	Graduation research project	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
Congratulations on reaching the stage of your graduation research project! The graduation research project is an important milestone in your academic journey, where you get the opportunity to delve into a specific topic of interest and showcase your research skills. Here are some steps to guide you through the process: Topic Selection: Choose a research topic that aligns with your interests and academic discipline. Consider the feasibility of the project, available resources, and the potential impact of your research. Consult with your advisor or mentor for guidance and to ensure that your chosen topic is suitable for a graduation-level project. Literature Review: Conduct a comprehensive review of existing literature and research related to your chosen topic. This will help you understand the current state of knowledge, identify research gaps, and define the research questions or objectives of your project. Analyze and synthesize the information gathered to form a solid theoretical foundation for your research. Research Design and Methodology: Determine the appropriate research design and methodology for your project. Consider whether you will be conducting experimental research, observational studies, surveys, interviews, or a combination of methods. Define your variables, sampling strategy, data collection procedures, and data analysis techniques. Ensure that your research design is rigorous and aligns with your research objectives. Data Collection: Implement your chosen data collection methods to gather relevant data for your research. This may involve conducting experiments, administering surveys, collecting field data, or analyzing existing datasets. Ensure that you adhere to ethical considerations and obtain any necessary			

approvals or permissions before collecting data.

Data Analysis: Once you have collected your data, analyze it using appropriate statistical or qualitative analysis techniques. Interpret the results and draw conclusions based on your findings. Ensure that your analysis aligns with your research objectives and addresses your research questions.

Discussion and Conclusion: Discuss your research findings in the context of existing literature and theories. Evaluate the significance and implications of your results, highlight any limitations or challenges encountered during the research process, and propose future research directions. Provide a concise and logical conclusion that summarizes your key findings and their contribution to the field.

Report Writing: Prepare a well-structured and coherent research report or thesis based on the guidelines provided by your academic institution. Include sections such as an abstract, introduction, literature review, methodology, results, discussion, and conclusion. Pay attention to formatting, citation style, and referencing guidelines. Seek feedback from your advisor or mentor to ensure the quality and clarity of your report.

Presentation and Defense: Prepare a presentation of your research findings and be ready to defend your project in front of an academic committee or panel. Create visually engaging slides and effectively communicate your research objectives, methods, findings, and conclusions. Address any questions or critiques raised by the committee with confidence and clarity.

Finalize and Submit: Revise and finalize your research report based on feedback received during the defense. Make sure to proofread for grammar and spelling errors. Follow the submission guidelines of your institution and submit your completed research project within the specified deadline.

Remember to seek guidance and support from your advisor or mentor throughout the entire process. They can provide valuable insights, review your work, and help you navigate any challenges that may arise. Good luck with your graduation research project!

Module 37

Code	Course/Module Title	ECTS	Semester
BioT-675	Pathogenic bacteria	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61

Description

Pathogenic bacteria are bacteria that can cause disease. This article focuses on the bacteria that are pathogenic to humans. Most species of bacteria are harmless and are often beneficial but others can cause infectious diseases. The number of these pathogenic species in humans is estimated to be fewer than a hundred. By contrast, several thousand species are part of the gut flora present in the digestive tract. The body is continually exposed to many species of bacteria, including beneficial commensals, which grow on the skin and mucous membranes, and saprophytes, which grow mainly in the soil and in decaying matter. The blood and tissue fluids contain nutrients sufficient to sustain the growth of many bacteria. The body has defence mechanisms that enable it to resist microbial invasion of its tissues and give it a natural immunity or innate resistance against many microorganisms. Pathogenic bacteria are specially adapted and endowed with mechanisms for overcoming the normal body defenses, and can invade parts of the body, such as the blood, where bacteria are not normally found. Some pathogens invade only the surface epithelium, skin or mucous

membrane, but many travel more deeply, spreading through the tissues and disseminating by the lymphatic and blood streams. In some rare cases a pathogenic microbe can infect an entirely healthy person, but infection usually occurs only if the body's defense mechanisms are damaged by some local trauma or an underlying debilitating disease, such as wounding, intoxication, chilling, fatigue, and malnutrition. In many cases, it is important to differentiate infection and colonization, which is when the bacteria are causing little or no harm.

Module 38

Code	Course/Module Title	ECTS	Semester
BioT-676	Elective course1	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
This section includes a description of the module, 100-150 words			

Module 39

Code	Course/Module Title	ECTS	Semester
BioT-681	Plant tissue culture	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	86
Description			
Plant tissue culture is one of the modern biotechnology courses with high technical content and good application prospects. Through the lectures and experiments of this module,students can realise the position and role of tissue culture technology in the development of modern biotechnology. Plant tissue culture involves excising plant tissues and growing them on nutrient media. It is used rather broadly to include several variations, such as meristem culture for propagation of virus-free plants, protoplast culture, cell suspension culture, tissue and organ culture, and anther or pollen culture for producing haploid plants. This chapter focuses on various technical aspects of plant tissue culture. A suitable explant is selected and prepared for culture, and later incubated on an appropriate nutrient medium for growth and differentiation. The basic laboratory setup, handling of explant tissue, nutrient medium and establishing the culture, and incubation of cultures . A laboratory that can handle plant biochemistry or physiology-type experiments meets most of the general requirements of plant tissue culture. It is a valuable tool for research on morphogenesis, cell signaling, physiology, and molecular biology, as well as plant improvement by biotechnology.			

Module 40

Code	Course/Module Title	ECTS	Semester
BioT-682	Industrial microbiology	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71

Description
الاحياء المجهرية الصناعية /المرحلة الرابعة يتضمن تعريف الاحياء المجهرية الصناعية والتعرف على اهم انواع الاحياء المستخدمة على المستوى الصناعي وتوضيفها في انتاج المنتجات .واهم مميزات هذه الكائنات واستخداماتها التجارية بطريقة تضمن الحصول على المنتجات ب اقل كلفة اقتصادية وحسب حاجة السوق وتوفيرها على مدار السنة . حيث يتم انتاج الانزيمات والمضادات الحيوية وحامض الستريك وغيرها من المنتجات استخدام التجارب المختبرية ..

Module 41

Code	Course/Module Title	ECTS	Semester
BioT-683	Medical plant	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	86
Description			
The medicinal plants course offers students a comprehensive understanding of the diverse world of botanical medicine. This course focuses on the study of plants and their therapeutic properties, highlighting their historical use in traditional medicine and their relevance in modern healthcare practices. Students delve into various aspects of medicinal plants, including their identification, cultivation, extraction of active compounds, and their mechanisms of action. They explore the chemical constituents present in plants and their potential medicinal applications in treating common ailments and diseases. The curriculum covers a wide range of topics, such as phytochemistry, pharmacology, and ethnobotany. Students gain knowledge about the importance of sustainable practices in harvesting and conserving medicinal plants, as well as the regulations and ethical considerations surrounding their use. Throughout the course, students engage in practical exercises, laboratory work, and field trips to identify and collect medicinal plants. They also learn how to prepare herbal remedies and analyze their efficacy and safety. By the end of the course, students develop a strong foundation in the field of medicinal plants, enabling them to explore opportunities in herbal medicine, pharmacology, pharmaceutical research, and other related fields. They acquire the skills to critically evaluate scientific literature, understand the cultural significance of medicinal plants, and contribute to the sustainable and responsible use of botanical resources.			

Module 42

Code	Course/Module Title	ECTS	Semester
BioT-684	Antibiotics	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	71

Description
Antibiotics lectures are educational sessions that cover various topics related to antimicrobial drugs, their mechanisms of action, uses, side effects, and resistance. These lectures are typically given by experts in the field of infectious diseases, pharmacology, or microbiology, and are attended by healthcare professionals, researchers, and students. Antimicrobial lectures may cover a wide range of topics, including the different classes of antimicrobial agents, the development of new antimicrobial drugs, strategies for antimicrobial stewardship, and the impact of antimicrobial resistance on healthcare. These lectures are an important tool for keeping healthcare professionals up-to-date on the latest advances in antimicrobial therapy and providing them with the knowledge and skills needed to make informed decisions about prescribing antimicrobial drugs.

Module 43

Code	Course/Module Title	ECTS	Semester
BioT-685	Elective course2	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	86
Description			
This section includes a description of the module, 100-150 words			

Contact

Program Manager:
John Smith | Ph.D. in Biology | Assistant Prof.
Email:
Mobile no.:

Program Coordinator:
John Smith | Ph.D. in Biology | Assistant Prof.
Email:
Mobile no.