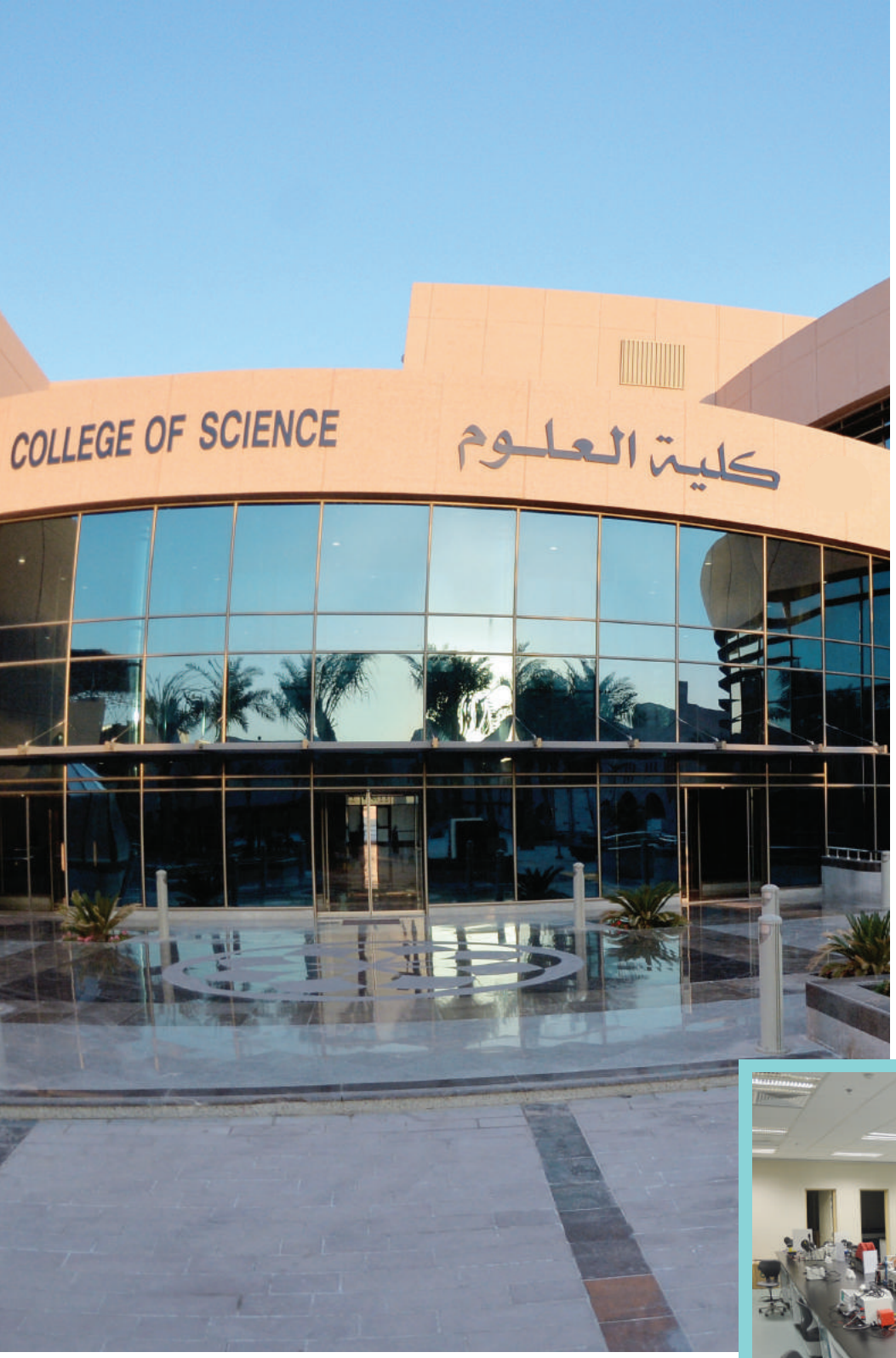

KING FAISAL UNIVERSITY
COLLEGE OF SCIENCE
MATHEMATICS AND
STATISTICS DEPARTMENT

Course Catalogue
Undergraduate
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Course Name	General Biology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-101	0826-101	1	3	
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

General Biology is designed to provide the fundamentals of biological science, its different branches, and its terminology. The units covered are associated with the following topics: molecular basis of life, cellular organization and function, cell divisions, cellular physiological processes, plant and animal form and function, biodiversity among living organisms and basics of ecology.

Course Outcomes

After the completion of this course, the student will be able to:

1. Outline biological macromolecules, cell structure, and their functions, and ecosystems.
2. Describe various animal and plant tissues and organ systems regarding their location and functions.
3. Recall the basic features of the diversity of life (Prokaryotes, protists, fungi, plant and animal kingdoms) with common examples.
4. Recognize the differences between different cellular processes such as cell division, respiration and photosynthesis.
5. Demonstrate responsibility and leadership to attribute to the current developments in biology and their applications.
6. Communicate with others and use the computer skills to perform presentations.

Assessment Policy								
	Presentation	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	P.H. Raven, G. B. Johnson), Kenneth A. Mason, Jonathan B. Loson, Susan R. Singer. Biology, McGraw-Hill Education, 11th edition. 2017.							
References	L. A. Urry, M. L. Cain, S. A. Wasserman, P. V. Minorsky, J. B. Reece. Campbell Biology, Pearson (2017).							

Course Name	General Biology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 111	0826111	1	1	
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The practical part of General Biology includes the samples which compatible with the general characters of different branches in biology. Thus, it covers the following topics: plant tissues anatomy and morphology, animal tissues and animal classification.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall various animal and plant tissues their location and functions.
2. Memorize the basic features of the diversity of life (Prokaryotes, Protista, Fungi, Plant and Animal kingdoms) with common examples.
3. Demonstrate responsibility and leadership to attribute to the current developments in biology and their applications.
4. Communicate the information and findings of biology and incorporate these findings into the existing body of knowledge in microbial genetics.
5. Examine microscopic slides under the light compound microscope and draw samples.

Assessment Policy	Assignment		Quiz		Lab		Project	-
	Midterms	40%	Final	40%	Others (Reports)	20%		
Textbook	D. S. Vodopich, Randy Moore, Biology Laboratory Manual Lab Manual. McGraw-Hill Education, (2016)							
References	D. R. Helms, C. W. Helms, J. C. Cummings, R. J. Kosinski, Biology in the laboratory. New York: W.H. Freeman and Co., (1998).							

<table>
<tr><td>Course Name</td><td colspan="3">Cell Biology</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio-201</td><td>0826201</td><td>3</td><td>2</td><td>General Biology (0826101)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
The course will cover basic concepts of cells as a unit of life. Topics include the biochemical structure of macromolecules of the cell, the structure and function of eukaryotic cell organelles including cell membrane and cytoskeleton. The course will focus on the mechanisms of cell-cell communications, cellular protein secretion, cytoskeleton dynamics, cellular bioenergetics, cell reproduction and cell death.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Define different cell organelles structure and function.
2. Describe cell reproduction, cell death and membrane transport mechanisms
3. Define how energies are synthetized in cell.
4. Explain the mechanisms of photosynthesis and aerobic respiration.
5. Differentiate between apoptosis and necrosis, phases of cell cycle, different types of cell transport mechanisms.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">L. A. Urry, M. L. Cain, S. A. Wasserman, P. V. Minorsky, J. B. Reece. Campbell Biology, Pearson (2017).</td></tr>
<tr><td>References</td><td colspan="7">C. E. Vincent. General Cytology: A Textbook of Cellular Structure and Function for Students of Biology and Medicine, University of Chicago Press Books, (2014).</td></tr>
</table>

Course Name	Cell Biology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-211	0826211	3	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course will provide the laboratory techniques to understand the basic and fundamental concepts of cell biology. The course will focus on training the students for the use of basic microscope, cell culture techniques, experimental preparation of animal and plant cells and observation of electron microscopic images of all subcellular organelles

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the structure of subcellular organelles
2. Implement cell isolation techniques to address different cell structures.
3. Demonstrate the gained knowledge to work in a team to conduct a specific project in cell biology
4. Demonstrate the ability to use computers and network to define the structure of cell organelles
5. Employ laboratory techniques to study plant and animal cells

Assessment Policy	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	L. P. Gartner, J. L. Hiatt. Color Atlas and Text of Histology, Lippincott Williams & Wilkins, 6th Edition, (2013).							
References	T. D. Pollard and W. C. Earnshaw. Cell Biology. WB Saunders Company, (2002).							

Course Name	Invertebrates				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-202	0826202	3	2	General Biology (0826101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course will cover the principles of invertebrates classification and binomial nomenclature. It will also differentiate between invertebrates groups (phyla) and classify invertebrates. Other topics include importance of invertebrates to human life and life cycles of most important invertebrate animals.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define invertebrate animals.
2. Recognize both internal and external structures of invertebrate animals.
3. Identify and classify given invertebrates.
4. Utilize internet and electronic resources to get all that new in invertebrate animals.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	R. L. Kotpal, Modern Textbook of Zoology – Invertebrates, Rastogi Publications, 11th edition, (2014).							
References	J. Moore, An introduction to invertebrates. Cambridge University Press, (2001).							

<table>
<tr><td>Course Name</td><td colspan="3">Invertebrates Lab</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-212</td><td>0826212</td><td>3</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
The present course covers a wide range of topics related to classification, and characteristic features of invertebrate groups.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define invertebrate animals.
2. Describe both internal and external structures of invertebrate animals.
3. Identify and classify given invertebrates.
4. Demonstrate invertebrates in their habitant
5. Utilize internet and electronic resources to get all that new in invertebrate animals.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td></td><td>Quiz</td><td></td><td>Lab</td><td></td><td rowspan="2">Field Trip</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others (Reports)</td><td>30%</td></tr>
<tr><td>Textbook</td><td colspan="7">S. S. Lal, Practical Zoology Invertebrate. Rastogi Publications, Uttar Pradesh, 11th edition, (2016).</td></tr>
<tr><td>References</td><td colspan="7">D. T. Anderson, Atlas of invertebrate anatomy. UNSW Press, (1996).</td></tr>
</table>

Course Name	Lab. Techniques				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-213	0826213	3	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course describe information about the materials and technologies used in preservation and preparation of animal and plant specimens, and the application of these technologies.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the standard methods of microscopic slide preparation.
2. Define the skills of preparation techniques in plants and animals specimens.
3. List the different steps of staining.
4. Distinguish between the different laboratory instruments and equipment.
5. Apply the concept of staining preparation, DNA and RNA extraction and test the whole mounts preparation,
6. Complete literature searches for individual research projects
7. Perform fixation, dehydration and clearing the specimen and embedding in paraffin wax.
8. Demonstrate the staining of pre-prepared section with Haematoxylin –Eosin & Mallory triple stains.

Assessment Policy								
	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	E. C. Tak Yeung, C. Stasolla, M. J. Sumner, B. Q. Huang, Plant Microtechniques and Protocols, Springer, (2015).							
References	M. Micic, Sample Preparation Techniques for Soil, Plant, and Animal Samples, Humana Press, (2016).							

Course Name	Plant Development and Diversity				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 204	0826204	3	2	General Biology (0826101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The aim of this course is to provide a basic background of plant kingdom diversity, structure, classification and evolution. The course starts with lower plants, following the evolutionary progression to higher plants (from Bryophyta to Tracheophyta). All groups classified as plants in the six-kingdom system of classification is used. Examples are emphasized and economic importance of the various groups.

Course Outcomes

After the completion of this course, the student will be able to:

1. Know the different taxa of lower and higher plants.
2. List the external and internal features of each plant taxon.
3. Identify the evolutionary relationships among plant taxa.
4. Explain the structure and evolution in different plant taxa.
5. Summarize the phylogenetic hypotheses of the plant kingdom.
6. Compare between the main taxa of the plant kingdom.
7. Participate in class discussions.
8. Use computer and internet to find resources related to the course topics.

Assessment Policy								
	Assignment	10 %	Quiz	25 %	Lab		Project	
	Midterm	25 %	Final	40 %	Others			
Textbook	D. Tran, D. Thang. Bryophytes, Pteridophytes, and Gymnosperms. Intelliz Press (2016).							
References	A.V.S.S. Sambamurty. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany, I K International House Pvt. Ltd. (2006).							

Course Name	Plant Development and Diversity Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 214	0826214	3	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course aims to provide the students with the knowledge about the basic structure, classification and diversity of plant kingdom. The course includes different slides and samples show the main characters of some examples of Bryophyta, Pteridophyta, Gymnosperms and Angiosperms.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the features of demonstrated samples.
2. Memorize the classification of demonstrated samples.
3. Differentiate between demonstrated plant samples.
4. Act responsibly and ethically in carrying out individual and group work.
5. Write a Lab. report.
6. Examine fresh, preserved or microscopic samples related to different plant taxa.
7. Draw and label the investigated samples.

Assessment Policy								
	Assignments	10 %	Quiz		Lab		Project	
	Midterm	10%	Final	40 %	Others (Reports)	40 %		

Textbook	1. M. Gufran, K. Gatew and Bekele. Practical Manual for Bryophytes and Pteridophytes. LAP Lambert Academic Publishing.(2012). 2. B. James. The Gymnosperms Handbook: A practical guide to extant families and genera of the world. Plant Gateway Ltd., (2015).
References	R. F. Evert, S. E. Eichhorn, J. Perry. Laboratory Topics in Botany, W. H. Freeman, 8th Edition. (2012).

Course Name	Histology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-205	0826205	4	2	Cell Biology (0826201)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course deals with fundamental concepts of basic tissues: (1) epithelial tissues; (2) connective tissues, including blood, bone and cartilage; (3) muscular tissues; and (4) nervous tissues. The course also provides an overview of the tissue organization of organs in relation to their function, as of respiration, digestion, etc.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the composition (histologic features) of animal tissues.
2. Explain the histological structure of various organs/systems.
3. Identify the primary cell types of major organs in the animal body.
4. Compare between tissue components.
5. Recognize the most important diagnostic features that characterize each tissue.
6. Correlate between the morphology (macro- and microscopic structure) of organs and their functions.

Assessment Policy								
	Assignment	10%	Quiz		Lab		Project	
	Midterm	25%	Final	40%	Others (Reports)	25%		
Textbook	L.C.U. Junqueira, and J. Carneiro. Basic Histology, McGraw-Hill, Medical Pub., 11th edition, (2005).							
References	W.K Ovalle, and C.N. Patrick. Netter's Essential Histology. Saunders/Elsevier, (2008).							

Course Name	Histology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-215	0826215	4	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course will focus on the microscopic architecture of the basic types of animal tissues, i.e., epithelium, connective tissue, muscle and nerve. The Lab topics will also include detailed histomorphology of body organs. Cells, fundamental tissues and organs will be studied with gross slides and microscopes. In addition, digital images of light and electron microscopic preparations will be used.

Course Outcomes

After the completion of this course, the student will be able to:

1. Identify different types of epithelium, connective tissues, muscle and nerve cells seen under the microscope.
2. Recognize different blood elements in blood films and electron micrographs.
3. Examine the structural features and different tissue elements of each organ (in histological slides and digital images).
4. Differentiate between histo-architecture of organs (using the microscope).
5. Draw and label histological slides seen during the course.
6. Demonstrate slides different from those seen during this course but of the same organs previously studied.

Assessment Policy	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	L.P. Gartnerand and L.H. James. Color Atlas of Histology. Lippincott Williams and Wilkins, (2006).							
References	C.N. Ovalleand Patrick Netter's Essential Histology. Saunders/Elsevier, (2008).							

Course Name	Plant Morphology and Anatomy				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 207	0826207	4	2	General Biology (0826101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course is an introduction to the basic external and internal structure of vascular plants. A full study of morphology of different plant organs and a detail anatomical study of plant cell, tissues and organs will be studied in this course. At the end of the course, the students will have good knowledge about vascular plants structure and their adaptation to the environmental conditions. Also, students will be able to compare between different organs and groups of plants depending on their morphological and anatomical features.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the morphological and anatomical characteristics of different plant organs and their modifications.
2. Recall the structure of plant cells as well as tissues and organs.
3. Differentiate among plant organs and groups (Monocot & Dicot) using morphological features and anatomical structures.
4. Explain how external and internal features of plants affected by their habitats.
5. Demonstrate his self-confidence, flexibility and the ability to work in groups.
6. Follow the update knowledge concerning the course demand using the internet.

Assessment Policy	Assignment	10%	Quiz	25 %	Lab		Project	
	Midterms	25%	Final	40%	Others			
Textbook	B. B. Charles. An Introduction to Plant Structure and Development - Plant Anatomy for the Twenty-First Century. Cambridge University Press,(2010).							
References	P. J. Rudall. Anatomy of Flowering Plants: An Introduction to Structure and Development. 3rd Edition, Cambridge University press,(2007).							

Course Name	Plant Morphology and Anatomy Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 217	0826217	4	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course aims to provide students with practical skills and knowledge required for understanding external and internal structures of different plant organs. During the course students will prepare high quality of morphological samples and slides.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe different morphological features in different plant samples.
2. Recognize the microscopic structure of plant cells, tissues and organs.
3. Apply the morphological and anatomical characteristics to differentiate between plant organs as well monocot and dicot plants.
4. Correlate between plant morphological and anatomical structure and its habitat.
5. Work independently and as part of a team.
6. Use computer and internet to follow up the topics related to the course.
7. Prepare good microscopic slides.
8. Draw the fresh plant samples and the microscopic slides.

Assessment Policy								
	Assignment	10 %	Quiz		Lab		Field Trip	15 %
	Midterm	10 %	Final	40 %	Others (Reports)	25 %		
Textbook	R. S. Sundara. Practical Manual of Plant Morphology. Anmol Publications Pvt Ltd, (2003).							
References	A. Bryan. Plant Form: An Illustrated Guide to Flowering Plant Morphology. Timber Press, (2008).							

Course Name	General Microbiology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-206	0826-206	4	2	General Biology (0826-101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers basic principles of microbiology. The course will cover characteristic, classification, structure of microorganisms. Topics include prokaryotic and eukaryotic microorganisms such as viruses, bacteria, cyanobacteria, microalgae, actinomycetes and fungi. Furthermore, their life cycles and interaction with each other as well as their interaction with the environment.

Course Outcomes

After the completion of this course, the student will be able to:

1. List the major groups of microorganisms, their role, taxonomy, growth and normal habitat.
2. Recognize the general characteristics, cell structure and the activities caused by various groups of microorganisms.
3. Summarize common features of microbial pathogens, with emphasis on bacterial, viral and fungal pathogens.
4. Explain the life cycle of a certain member of different group of microorganism.
5. Criticize by writing a report on a selected topic using correct format, style and language.
6. Demonstrate the ability to read, understand and search through the library and network.

Assessment Policy								
	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	M. T. Madigan, J. M. Martinko, and Jack Parker. Brock biology of microorganisms. 15th edition. Benjamin Cummings, (2019).							
References	G. J. Tortora, B.R. Funke, and C. L. Case. Microbiology: An introduction. 13 Edition, Pearson Education, Inc. (2018).							

<table>
<tr><td>Course Name</td><td colspan="3">General Microbiology Lab</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio 216</td><td>0826-216</td><td>4</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☒Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
This course includes standard microbiological techniques commonly used in microbiology labs such as sterilization, preparation of growth media, isolation and purification of different microbes. Microscopic examination of different groups of microorganisms and introduction to biochemical activities of microorganisms will also be covered.</td></tr>
<tr><td colspan="7">Course Outcomes
1. After the completion of this course, the student will be able to:
2. Define different shape of microorganisms.
3. Summarize the most important microbial activities causing by different microorganisms.
4. Deal with the library and internet search.
5. Illustrate different microscopic slide of different microorganisms.
6. Differentiate between Gram-positive and Gram-negative.
7. Examine the macroscopic and microscopic features of common molds.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td></td><td>Quiz</td><td></td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others (Reports)</td><td>30%</td></tr>
<tr><td>Textbook</td><td colspan="7">G. Emanuel, G. Lorrence. Practical Handbook of Microbiology, 3rd Edition, CRC Press, (2015).</td></tr>
<tr><td>References</td><td colspan="7">J. G. Cappuccino, C. T. Welsh. Microbiology: A Laboratory Manual, Global Edition. Pearson Education Limited, (2017) .</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="3">General Genetics</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio-208</td><td>0826-208</td><td>4</td><td>2</td><td>General Biology(0826101)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
The initial part of the course will focus on the classical principles of genetics emphasizing Mendelian and non-Mendelian inheritance, Mendelian Laws and exception to Mendel's laws such us incomplete dominance, epistasis, Gene interactions and evolutionary genetics. The course will consist of other various topics including inheritance of Autosomes versus sex-linked traits, recombination and gene mapping, Human mutations, Introduction to the laws of probability and Biometry. The Hardy-Weinberg principle and population genetics. The composition and structure of DNA, RNA and protein and describe the structure and function of a gene.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Describe the process and purposes of the cell cycle, meiosis, and mitosis, as well as predict the outcomes of these processes.
2. Define genetics terms, allelic/non allelic reactions and gene function
3. Recognize Mendelian principles, genetic material and its transmission from generation to generation in organisms.
4. Analyzes crosses, rules and methods of heredity.
5. Apply genetics principles to make accurate predictions about inheritance of genetic traits and gene mapping.
6. Give interpretation and carryout calculations in analysis of genetics cases and gene frequencies.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="5">R. J. Brooker. Genetics, Analysis and Principles, Mc Graw-Hill, (2011).</td></tr>
<tr><td>References</td><td colspan="5">W. Jastania. Epidemiology of sickle cell diseases in Saudi Arabia. Ann Saudi Med 31 (3), (2011).</td></tr>
</table>

Course Name	General Genetics lab.				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-218	0826218	4	1	None
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers principles of practical genetics including: Preparation of mitosis and meiosis stages by squash method in Onion and Zea maize flowers. Mendlian ratios, endosperm color in Zea maize ears (Black and white, sugary and starchy etc.). Investigation of polytene chromosomes and linkage in fruit fly in addition to sickle cell smears and human blood group.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the role Mendel principles in formation genetic traits in Zea maize ears and fruit fly
2. Know simple Mendlian characters in human
3. Analyze the process of cell division and its role in gene transmission processes
4. Apply rules and methods of analysis to interpret the transmission of genes from generation to generation
5. Give interpretation and carryout calculations in analysis of genetics cases and gene frequencies
6. Preparation of laboratory materials, slides and use of microscope for illustrating individuals karyotypes

Assessment Policy								
	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	R. Lewis. Human Genetics, Concepts and Applications, 7th ed., McGraw Hill (2014).							
References	R. J. Brooker. Genetics, Analysis and Principles, Mc Graw-Hill, (2009).							

Course Name	**Comparative Vertebrate Anatomy**				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Bio-301	0826301	5	2	General Biology (0826-101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course Deals with comparative anatomical structures of different classes of vertebrates including: Integumentar, Skeletal, Muscular, Circulatory, Excretory, and Nervous system. An emphasis on the functional significance of structures and how suit to fit to different ecological conditions will be addressed.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize how to differentiate between the dermal system among vertebrates
2. Define the exoskeletal derivatives of each animal
3. Recall each class in its taxonomic position according to the modifications of structures of different organs in each taxa.Analyze the symptoms of diseases and recognize the specific symptoms of each disease.
4. Apply function of organ-systems, and their adaptation with environment
5. Demonstrate anatomical comparative of structures and functions of organs and environments.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	K. Kardong and E. Zalisko. Comparative Vertebrate Anatomy: A Laboratory Dissection Guide. Kenneth (2011).							
References	K. Liem, W. Bemis, W. F. Walker, and L. Grande. Functional Anatomy of the Vertebrates: An Evolutionary Perspective. Cengage Learning, (2000).							

Course Name	Comparative Vertebrate Anatomy Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-311	0826311	5	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course will focus on the structural and functional dermal and skeletal system involved in regulating animal development. Laboratories use live material whenever possible for specific topics including formation of early body exoskeleton, organogenesis, and morphogenesis. This course deals also with the structure of the skin among vertebrates referring the exoskeletal derivatives and the endoskeleton.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize how to differentiate between the dermal system among vertebrates - List the exoskeletal derivatives of each animal
2. Define each class in its taxonomic position according to the modifications of structures of different organs in each taxa.-
3. Recall the exoskeletal derivatives of each animal Work in groups
4. Implement the morphological and anatomical characters as principals for classification
5. Demonstrate anatomical comparative of structures and functions of organs and environments.
6. Employ data from a variety of sources (e.g., libraries, databases, and computer networks) to gather and synthesize information, and communicate knowledge

Assessment Policy								
	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	C. K. George and L. Miller. C. Wm. Comparative Anatomy of the Vertebrates. Brown Publishers. (1997).							
References	K. Kardong and E. Zalisko Comparative Vertebrate Anatomy: A Laboratory Dissection Guide.McGraw-Hill Higher Education (2011).							

Course Name	Plant Taxonomy and Flora				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 302	0826302	5	2	Plant Morphology and Anatomy (0826207)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course is composed of two parts, flowering plant taxonomy and Flora of KSA. The part of Taxonomy will introduce the principles of flowering plant taxonomy. The students will study history and methods of plant taxonomy, flower as a reproductive organ, pollination and fertilization as well as sources of taxonomy characters such as inflorescence and fruits. The course also addresses families' description and identification. In the Flora part, phytogeography of KSA is addressed together with herbarium establishment with special focus on plant collection and preservation. The course also includes a general survey of Flora of KSA and Al-Ahsaa specifically.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize different systems of plant classification.
2. List sources of taxonomic characters.
3. Recognize wild and cultivated plants from their floral characters.
4. Classify different plants into their taxonomic ranks.
5. Demonstrate responsibility for achieving tasks.
6. Use the internet to update the knowledge concerning the course.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	1. A. Balfour. Plant Taxonomy. Syrawood Publishing House, (2016). 2. A. M. Migahid. Flora of Saudi Arabia. King Saud University,(2014)							
References	W S .Judd. Plant Systematics: A Phylogenetic Approach. OUP Higher Education Division, (2015).							

Course Name	Plant Taxonomy and Flora Lab.				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 312	0826312	5	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This practical course is divided into two distinct themes with a practical exam dedicated to each theme: Taxonomy and Flora. In Taxonomy part, students will study the flower, floral parts and the floral formulas and diagram of different families representing major groups of flowering plants. In the Flora part, the establishment of Herbarium and Plant collection and preservation is studied. Also the flora from KSA in general and from Al-Ahsaa specifically will be focused on.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe different floral parts.
2. Identify inflorescences and fruits as taxonomic characters.
3. Correlate between unknown flower and its family using taxonomic keys.
4. Apply the proper taxonomic scheme and nomenclature to plants.
5. Show responsibility in achieving tasks in field.
6. Search in internet for updated information concerning the course
7. Dissect the flower professionally and draw its different parts.
8. Prepare well identified Herbarium sheets of plant samples.

Assessment Policy								
	Assignment	10%	Quiz		Lab		Field Trip	15%
	Midterm	10%	Final	40%	Others (Reports)	25%		

Textbook	1. R. K. Sinha. Practical Taxonomy of Angiosperms. I.K. International Publishing House Pvt. Limited,(2010). 2. A. M. Migahid (2014). Flora of Saudi Arabia. King Saud University.
References	J. G. Harris and M. W. Harris. Plant Identification Terminology: An Illustrated Glossary, Spring Lake Pub (2001).

<table>
<tr><td>Course Name</td><td colspan="3">Microbial Physiology</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio-303</td><td>0826303</td><td>5</td><td>2</td><td>General Microbiology (0826-206)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
This course focuses on the microbial physiological processes that are performed by microorganisms with examples from bacteria, fungi and microalgae. The course gives an overview of central metabolic pathways with some reference to their ecological and biotechnological importance.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Define different modes of microbial nutrition
2. Define different physiological processes involved in nutrition, energy generation, locomotion and antibiotic resistance
3. Define the roles of enzymes in different physiological processes.
4. Recognize growth requirements and conditions suitable for growth of different microorganisms.
5. Recognize the factors leading to biofilm production and antibiotic resistance
6. Interact responsibly and actively with others for achieving tasks related to the course.
7. Develop advanced web search capabilities</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">M.T. Madigan, J.M. Martinko, D. Stahl, and D.P. Clark. Brock: Biology of Microorganisms 13th eds., Prentice Hall (2010).
D. White, J. Drummond and C. Fuqua .The Physiology and Biochemistry of Prokaryotes. Published by Oxford University Press, Inc., (2012).</td></tr>
<tr><td>References</td><td colspan="7">A. G. Moat, J. W. Foster, and M. P. Spector. Microbial physiology. Wiley-Liss, Inc., 4th Edition, (2002).</td></tr>
</table>

Course Name	Microbial Physiology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-313	0826313	5	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course focuses on experimentally studying the different microorganisms and their different modes of nutrition and growth requirements. Different physiological processes are addressed such as aerobic respiration, fermentation, photosynthesis and nitrogen fixation. Stress tolerance and antibiotic resistance are also demonstrated.

Course Outcomes

After the completion of this course, the student will be able to:

1. Determine the growth conditions suitable for the autotrophic and heterotrophic modes of nutrition.
2. Define the diverse effects of enzymes in different physiological processes.
3. Select the growth medium and conditions suitable for growth of different microorganisms.
4. Compare between physiological activities performed by microorganisms under different conditions and their requirements.
5. Use effectively basic techniques in lab. group works.
6. Deal with the library and internet search

Assessment Policy								
	Assignment		Quiz		Lab		Project	
	Midterm	40%	Final	40%	Others (Reports)	20%		

Textbook	1. M.T. Madigan, J.M. Martinko, D. Stahl, and D.P. Clark. Brock: Biology of Microorganisms. Prentice Hall, 13th eds., (2010). 2. D. White, J. Drummond and C. Fuqua .The Physiology and Biochemistry of Prokaryotes. Published by Oxford University Press, Inc., (2012).
References	A. G. Moat, J. W. Foster, and M. P. Spector. Microbial physiology. Wiley-Liss, Inc., 4th Edition. (2002).

Course Name	Entomology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-304	0826304	6	2	Invertebrates (0826202)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course introduces the internal and external structures of insects and their functions, classification and identification. Topics also include an introduction to insect control, recognition of economically important beneficial and destructive insects, with special emphasis on their life histories and behavior.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the external and internal insect body parts and their modifications
2. Outline the morphological and anatomical characters as principal keys for insect taxonomy
3. Recognize the economic and medical importance, life cycles of pests and control
4. Reconstruct the morphological and anatomical characters for designing insects classification keys
5. Analyze the symptoms of diseases and recognize the specific symptoms of each disease.
6. Deal with the library and internet search

Assessment Policy								
	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	P. J. Gullan and P. S. Cranston. The insects: an outline of entomology. Wiley-Blackwell. 5th edition, (2014),							
References	Chapman R. F. The Insect structure and function. Cambridge University Press, 4th edition, (1998).							

Course Name	Entomology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-314	0826314	6	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course includes basic morphological and anatomical features of insects as well as insect classification. The course will focus on some economic and medical insects and use of insecticides for insect control.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the external and internal insect body parts and their modifications
2. Outline the morphological and anatomical characters as principals for classification
3. Describe insecticide formulations and application
4. Apply the morphological and anatomical characters for insects classification
5. Analyze the results of insecticide toxicity
6. Deal with the library and internet search

Assessment Policy								
	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	M. M. Trigunayat. A Manual of Practical Entomology, Scientific Publisher.3rd Edition, (2016),							
References	Chapman R. F. The Insect structure and function. Cambridge University Press, 4th edition, (1998).							

Course Name	Molecular Biology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-305	0826-305	6	2	General Genetics (0816208)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course introduces student to the genetic materials: Nucleic acids as well as proteins. This course will highlight some of the concepts learned in other courses such as General Genetics, only at the molecular level. Students are also introduced to the reasoning behind experiments while practicing some related techniques in the laboratory. This course, also, aims to prepare students to apply knowledge and techniques of molecular biology in answering questions by designing and executing experiments at the graduate level and analyzing the obtained data.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall the nucleic acids structures, types, and functions with emphases on the relation among nucleic acids as well as with proteins.
2. Memorize DNA replication and gene expression in eukaryotes and prokaryotes.
3. Analyze the principles of different techniques used in molecular biology such as PCR, RT-PCR, 4.genomic and cDNA library, southern and northern blotting.
4. Build self-esteem by encouraging students to think independently while cooperating with other students during various activities.
5. Demonstrate Nanoscale measurements (calculation of DNA size, primers melting temperature).

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	Alberts et al. Molecular Biology of the cell. Garland Science. 6th Edition. (2014).							
References	S. Freeman. Biological Sciences. Brnjmn Cmngs, 3rd Edition. (2008)							

Course Name	Molecular Biology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-315	0826-315	6	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course introduces student to the fundamental techniques of molecular biology like, extraction of genomic DNA from plant tissues and bacteria, the use of PCR in DNA replication, Gel electrophoresis, restriction digestion and cloning of DNA. Learning the extraction of RNA and an introduction to bioinformatics gene bank and blast is necessary.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the details of some lab techniques such as: extraction of DNA and RNA, PCR, Electrophoresis, Cloning, Southern blot, DNA Typing.
2. Explain the role of the modern techniques for molecular biology in genetic diseases diagnosis and proof of identity.
3. Analyze the results of practical experiments and demonstrate precision in observations and distinguishing differences.
4. Build self-esteem by encourage the Students to think independently, as well as working in a team to problem solve and time management.
5. Estimate the concentrations and purity of DNA and RNA; calculate (the number of restriction enzymes units, lab solutions preparation).
6. Prepare biological specimens and agarose gel, isolate DNA from plant cells and operate gel electrophoresis apparatus.

Assessment Policy								
	Assignment	5%	Quiz	20%	Lab		Project	
	Midterm	30%	Final	40%	Others (Reports)	5%		

Textbook	1. Alberts et al., Molecular Biology of the cell. New York: Garland Science. 6th Edition. (2014). 2. J. Wilson, T. Hunt. Molecular Biology of the Cell. The Problems Book. Garland Science. 6th Edition, (2014).
References	S. Freeman. Biological Sciences. 3rd Edition. Brnjmn Cmngs, (2008)

Course Name	Plant Physiology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 306	0826306	6	3	Biochemistry 1 (0825207)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course provides an introduction to basic principles of plant function including physical processes occurring in plants, water relations in whole plants and plant tissues, cell physiology and biochemistry, plant mineral nutrition, and growth and development. Also, the course addresses important environmental factors influencing plant growth and how plants reacting to these factors.

Course Outcomes

After the completion of this course, the student will be able to:

Comprehend the fundamental concepts of plant physiology.

1. Describe the physiological and biochemical mechanisms of plant growth, function, and development.
2. Recognize how plants respond to their environment.
3. Explain different metabolic pathways and the role of enzymes.
4. Explain the mechanisms of mineral ions absorption by plants, roles of these minerals and their deficiency symptoms.
5. Summarize the major effects and physiological mechanisms of plant growth regulators (hormones).
6. Participate in class discussions.
7. Use computer and internet to find resources related to the course topics.

Assessment Policy								
	Assignments	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	W. G. Hopkins and N.PA Hüner. Introduction to Plant Physiology, John Wiley & Sons.4th ed. (2008).							
References	L. Taiz, and E. Zeiger. Plant physiology, Sinauer Associates, 6th ed., (2015).							

Course Name	Plant Physiology Lab.				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 316	0826316	6	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course consists of a series of laboratory experiments and exercises to familiarize students with main concepts and phenomena in plant physiology. During the course, students will perform and demonstrate experiments about some topics in plant physiology as water relations, mineral nutrition, photosynthesis, respiration and plant growth regulators.

Course Outcomes

After the completion of this course, the student will be able to:

1. Use plant physiology concepts and terminology accurately.
2. Apply the concepts and information of plant physiology to understand and comment on laboratory experiments.
3. Work effectively in groups and exercise taking responsibility for achieving tasks.
4. Write good scientific reports.
5. Refine their skills in presenting scientific data.
6. Use basic equipment effectively in the laboratory.
7. Able to handle materials safely and analyze data in the laboratory.

Assessment Policy								
	Assignment		Quiz		Lab		Project	20 %
	Midterm	10 %	Final	40 %	Others: (reports)	30 %		

Textbook	A.Choudhuri, and K. K.Gupta. Practical plant physiology, New Central Book Agency, (2009). H. S. Aldesuquy. Practical plant physiology. Gazirat Al- Ward Library- Cairo-Egypt, (2008).
References	T. C. Moor. Research Experiences in Plant Physiology. A laboratory Manual. Springer-Verlag, (1981).

<table>
<tr><td>Course Name</td><td colspan="3">Animal Physiology</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-307</td><td>0826307</td><td>6</td><td>3</td><td colspan="2">Histology (0826-205)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
The course will study the physiology of different principal body systems in animals, how they operate and how they are regulated. Topics include nervous, muscular, cardiovascular, respiratory, renal, digestive, and endocrine physiology. The coordination between systems will be in focus.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Describe the structures and functions of different organs in some body systems.
2. Recognize the importance of the mammalian different systems.
3. Identify different types of muscles, nerve cells, hormones and blood cells.
4. Explain the mode of actions of hormones, sense organs and mechanism neurotransmission.
5. Interpret the different metabolic pathways, mechanism muscle contraction, urine formation
6. Conduct a specific project in animal physiology.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10 %</td><td>Quiz</td><td>25 %</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25 %</td><td>Final</td><td>40 %</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">S. I. Fox. Human Physiology. Mc Grow-Hill Companies, 13th Edition, (2012) .</td></tr>
<tr><td>References</td><td colspan="7">J.A. Rall. Mechanism of Muscular Contraction Ed. Springer, (2014).</td></tr>
</table>

Course Name	Animal Physiology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-317	0826317	6	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The practical course describes how different systems work in detail with special experiments for each system. Disease markers rates detection will be studied in comparing with healthy ones. Focus light on the physiology of different systems in healthy and diseased status.

Course Outcomes

After the completion of this course, the student will be able to:

1. Label the route of food through a mammalian digestive system and define respiratory conducting system.
2. Recognize different endocrine glands, nerves, types of muscles, sense organs.
3. Explain the enzymes mode of action.
4. Analyze the food components and blood components.
5. Calculate blood counts and indices by equations.
6. Construct different experiments and using different devices.

Assessment Policy	Assignment	10 %	Quiz	20%	Lab	10%	Project	
	Midterm	20%	Final	40%	Others			
Textbook	C.L., M.D. Ghai. A Textbook of Practical Physiology: Jaypee Brothers Medical Publishers (2013).							
References	S. I. Fox. Human Physiology. McGrow-Hill Companies, 13th Edition (2012).							

Course Name	Summer Training				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-399	0826399	6	3	81 gained credit hours
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

The Summer Training Program is a training for 6 weeks during the Summer semester of the third year. It is oriented to the students, after finishing 81 gained credit hours. It aims to provide those students the basic skills that qualifies them to join the labor market.

Course Outcomes

After the completion of this course, the student will be able to:

1. Have hands on Biological projects, capable of comprehending, abstracting and summarizing Biology information.
2. Record and list all gained skills
3. Explain the enzymes mode of action.
4. Enhance student ability to collect, analyze, manipulate data, draw conclusions, and perform error analysis Develop a research plan and investigate an area of interest
5. Demonstrate the integration of Biological information in essential needs.
6. Develop technical skills and Create a spirit of innovation
7. Demonstrate the skills required in the work environment. Contribute to meaning of working environment
8. Analyzing the experimental data, write report and present data.

Assessment Policy	Weekly Reports	15%	Evaluation (Training center)	35%	Lab		Project	
	Final Report	35%	Presentation	15%	Others			
Textbook								
References								

Course Name	**Plant Ecology**				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio- 401	0826401	7	3	Plant Taxonomy and Flora (0826302)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Plant Ecology is the study of plants in relation to their environment. The course explores the definition of the Ecology, ecosystem components, environmental succession, plant communities and their general characteristics. It covers both autecology and synecology so that students recognize the spectrum of environmental factors (abiotic and biotic) and how these factors influence individual plant and communities. The course includes studies on the bio-geochemical cycles, different levels of organization of living matter and mechanisms of plant adaptation to their habitats (Hydrophytes, Xerophytes and Mesophytes). It focuses on the succession, ecosystem conservation, dynamics of communities and ecosystems as well as the human impact and the effect of environmental pollution (sources and types of pollutants), and global change on plant ecology.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the major and fundamental concepts, in plant ecology: biotic and abiotic factors, their inter/intra relationships with plant life and plant adaptation and abundance.
2. Recognize the characteristics of different plant populations and communities, the effects of climate change and pollution on plants, water and soil.
3. Classify the different local environmental habitats, climate, populations and communities.
4. Correlate the effect of various ecological factors on distribution and adaptation of plants in Saudi Arabia and in the world.
5. Working in groups and class discussion.
6. Use computer and internet to follow up the topics related to the course.

Assessment Policy								
	Assignment	5 %	Quiz	25 %	Lab		Project	
	Midterm	25%	Final	40 %	Others (Reports)	5 %		
Textbook	P. A. Keddy. Plant Ecology: Origins, Processes, Consequences. Cambridge University Press, 2nd edition, (2017).							
References	http://jpe.oxfordjournals.org/(Journal of plant Ecology) https://link.springer.com/journal/11258 (Plant Ecology)							

Course Name	Plant Ecology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-411	0826411	7	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course provides students with principal knowledge and concepts of plant ecology. During this course students will recognize and measure some climatic and edaphic factors (determination of soil parameters such as physical and chemical soil properties). They could analyze different types of vegetation and plant communities. The relationships between plants and their environment will also be included.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize some climatic factors such as light, temperature, humidity.
2. Recall knowledge of various laboratory techniques in plant ecology such as some tools, apparatus, procedures and basic concepts.
3. Apply appropriate techniques and experiments to measure some soil parameters.
4. Correlate between the physical and chemical properties of soil and vegetation.
5. Demonstrate responsibility and leadership to measure some attributes (vegetation analysis and soil analysis).
6. Analyze collected data from lab and field experiments.
7. Perform some Lab and field experiments.

Assessment Policy								
	Assignment	15 %	Quiz		Lab		Field Trip	15 %
	Midterm	10 %	Final	40 %	Others (Reports)	20 %		
Textbook	D.R. Chalise, A. Sharma. Fundamentals of Soil Science and Geology: Physico-chemical properties of soil and soil genesis. LAMBERT Academic Publishing.(2012).							
References	http://jpe.oxfordjournals.org/ (Journal of plant Ecology)							

<table>
<tr><td>Course Name</td><td colspan="3">Developmental Biology</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-402</td><td>0826402</td><td>7</td><td>2</td><td colspan="2">Molecular Biology (0816-305)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☒Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
Course covers the current understanding of animal development at tissue, cellular, and molecular levels. Specific topics include formation of early body plan, cell type determination, organogenesis and morphogenesis.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the steps of Gametogenesis and the cell cleavage.
2. Recognize the axis formation, neural development and organogenesis
3. Apply the morphogenesis among vertebrate animals after knowing the type of eggs.
4. Implement different environmental factors that affect development
5. Demonstrate different aspects of developmental biology</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">F. G. Scott, Developmental Biology, Sinauer Associates, 9th Edition. (2010).</td></tr>
<tr><td>References</td><td colspan="7">L. Wolpert, et al. Principles of Development. Oxford University Press,5th ed. (2015).</td></tr>
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<table>
<tr><td>Course Name</td><td colspan="3">Developmental Biology lab</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-412</td><td>0826412</td><td>7</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
The course investigates the cellular and molecular processes involved in regulating animal development. Laboratories use live material whenever possible for Specific topics include formation of early body plan, cell type determination, organogenesis, morphogenesis, role do embryonic and adult stem cells play during development.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the formation of three layers of cells (germ layers), gametogenesis and cell differentiation.
2. Apply the morphogenesis among vertebrate animals after knowing the type of eggs.
3. Implement different factors that effect on Limb and eye development.
4. Demonstrate responsibility to attribute to the aspects of developmental biology
5. Employ the age of chick and human embryo from the number of myotomes.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td></td><td>Quiz</td><td></td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others (Reports)</td><td>40%</td></tr>
<tr><td>Textbook</td><td colspan="7">M. Marí-Beffa and J. Knight. Key Experiments in Practical Developmental Biology. Cambridge University Press, (2009).</td></tr>
<tr><td>References</td><td colspan="7">L. Wolpert, et al. Principles of Development 5th ed. Oxford University Press (2015),</td></tr>
</table>

Course Name	Parasitology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-403	0826403	7	2	Invertebrates (0826-202)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course shall give a broad view of general parasitology with respect to types of parasites, type of hosts, relationship between parasite and host, effect of parasitism on hosts, study on some important protozoa, helminths and arthropods that infect man and animals in relation to their classification, distribution, habitat, morphology, life cycle and pathogenicity.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the main characteristics of Protozoa, Platyhelminthes and Arthropoda and list some examples for each definition introduced in the course.
2. Explain disease caused pathological effect on the host, diagnostic stages, and treatment for a select human and veterinary parasite.
3. Recall the classification of Protozoa, Platyhelminthes and Arthropoda Phyla.
4. Recognize different parasitic examples among animal kingdom.
5. Describe selected parasitic life cycles and route of infection.
6. Show independent thinking.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	L. Roberts, J Janovy, Jr. and S. Nadler: foundations of parasitology, 9th Ed, McGraw-Hill Education, (2013).							
References	P. L. Chiodini, A. H. Moody and D. W. Manser. Atlas of medical helminthology and protozoology. Churchill Livingstone.4th Ed., (2001).							

Course Name	Parasitology lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-413	0826413	7	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course will examine and identify the microscopic morphology of commonly occurring parasites and their life cycle-stages in fixed stained smears, in addition to study different protozoa, helminths and arthropods and their hosts with special emphasis on the taxonomy, morphology, life cycles, and histopathology.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall the classification of Protozoa, Platyhelminthes and arthropods Phyla.
2. Identify microscopic morphology of commonly occurring parasites and their larval stages
3. Describe selected parasitic life cycles and route of infection.
4. Demonstrate structural reports in accordance with the standard scientific guidelines.
5. Show different samples of parasites and their different stages of life cycles as stained slides under light microscope and draw.

Assessment Policy	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	G.D. Schmids, and L.S. Roberts, Foundation of parasitology.McGraw Hill, (2000).							
References	https://www.mcgill.ca/chpi/links/parawebs parasites-world.com							

<table>
<tr><td>Course Name</td><td colspan="3">Applied Microbiology</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-404</td><td>0826404</td><td>7</td><td>2</td><td colspan="2">Microbial physiology (0826303)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
This course covers principles of applied microbiology and microbial technology. The course provides an overview on the utilization and application of microbes in different products and processes. Moreover, the course discusses the interrelationship between microbes and the environment in which they exist, changes that microorganisms do in water, dairy, sewage, food, and industry.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define and describe the basic groups of microorganisms.
2. Describe microbial biochemical pathways and relate them to important industrial processes.
3. Assess the use of microbes as tools in biotechnology.
4. Relate their knowledge of traditional microbiological techniques to the utilization and control of microorganisms.
5. Summarize the roles of microbes in industrial and food processes.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">M.J. Waites, N.L. Morgan, J.S. Rockney and G. Highton. Industrial Microbiology. An Introduction , Blackwell Science Publishers, (2001).</td></tr>
<tr><td>References</td><td colspan="7">G. j. Tortora et.al. Microbiology (An Introduction), Pearson
12th Edition, (2015)</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="3">Applied Microbiology Lab</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-414</td><td>0826414</td><td>7</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Course Track</td><td colspan="6">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
This course covers introduction to microbiological tools, media types, culture collection methods. Direct Microscopic Count of Microorganisms in Milk will be included. The course provides a practical overview on production of bioactive compounds, enzymes, antibiotics, phytohormones. Moreover, the course provides skills on water quality and biochemical characterization using commercially available systems.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Describe the roles of microbes in industrial and food processes.
2. Assess the use of microbes as tools in biotechnology.
3. Relate their knowledge of traditional microbiological techniques to the utilization and control of microorganisms.
4. Evaluate microbial growth and death rates.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td></td><td>Quiz</td><td></td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Mid term</td><td>40%</td><td>Final</td><td>40 %</td><td>Others (Reports)</td><td>20%</td></tr>
<tr><td>Textbook</td><td colspan="7">F. Duncan, Applied Microbiology Lab Manual. Kendall Hunt Publishing, (2009).</td></tr>
<tr><td>References</td><td colspan="7">G. j. Tortora et.al. Microbiology (An Introduction), Pearson, 12th Edition, (2015).</td></tr>
</table>

Course Name	Plant Biotechnology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio- 405	0826405	7	2	Plant Physiology (0826306)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The aim of this course is to provide knowledge and understanding of plant biotechnology. The course explores the basic principles and application of tissue, cell and protoplast culture. It includes studies on recombinant DNA technology and genetic transformation of plants and its application in plant improvement.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall fundamental concepts and principles of plant biotechnology and cell & tissue culture.
2. Know different methods and techniques in plant biotechnology disciplines.
3. Analyze components of tissue culture media.
4. Explain totipotency and morphogenesis.
5. Show the production of transgenic plants, their products and safety.
6. Show the future of plant biotechnology.
7. Use the computer and the Internet to perform reports and other tasks.

Assessment Policy								
	Assignment	5 %	Quiz	25 %	Lab		Project	-
	Midterm	25 %	Final	40 %	Others (Reports)	5 %		
Textbook	S. Umesha. Plant Biotechnology. The Energy and Resources Institute, TERI. (2017).							
References	D. Murphy. Plants, Biotechnology and Agriculture. CABI, (2011).							

Course Name	Plant Biotechnology Lab.				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio- 415	0826415	7	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The aim of this course is to provide knowledge of the basic principles of plant biotechnology through different applications such as plant tissue culture.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe different sterile techniques and media preparation.
2. Recognize the principles, technical requirements, scientific and commercial applications of plant biotechnology.
3. Identify different methods in plant cell/tissue culture.
4. Explain different methods and techniques in plant biotechnology.
5. Work individually as well as in groups.
6. Use computer and internet to search for information.
7. Perform some lab experiments.

Assessment Policy								
	Assignment		Quiz		Lab		Project	20 %
	Midterm	10 %	Final	40 %	Others (Reports)	30 %		

Textbook	1. M. Adhav. Practical Book of Biotechnology & Plant Tissue Culture. Kindle Edition, (2018). 2. B. D. Singh .A Laboratory Manual Of Plant Biotechnology. Centrum Press(2017).
References	C. N. Stewart. Plant Biotechnology and genetics, principles, techniques and applications, Wiley, (2016).

Course Name	Graduation project				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-406	0826-406	7	2	98 gained hour
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Graduation project is a broad overview course designed to give an introduction to the core tenets of how students deal with the scientific research. Basic concepts covered in the course are the basic definition of scientific research, concept and practical skills of research, how to deal with the experiments in the lab. How to deal with the experimental organisms and microorganisms, and how to write scientific reports and papers.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize basic principles of scientific research.
2. Appropriate research methodologies and techniques in different Biological fields.
3. Design an experimental protocol of graduation project.
4. Generate reliable data in a suitable way to explain the biological basis of different experimental observation.
5. Cooperative learning concepts and Working in groups.
6. Writing reports, using software programs, read scientific literature and giving presentation
7. Perform various laboratory techniques; use the appropriate laboratory tools and equipment.

Assessment Policy	Assignment		Quiz		Lab		Project	50%
	Midterm		Final		Others (Presentation)	50%		
Textbook	H. Glasman. Science research writing: For non-native speakers of English. Imperial College Press, (2010).							
References	D. R. Boone, R. W. Castenholz, G. M. Garrity, D. J.Brenner, N. R.Krieg, and J. T. Staley. Bergey's Manual® of Systematic Bacteriology Springer Science & Business Media. (2015)							

Course Name	Animal Ecology and Behavior				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-407	0826407	8	2	Animal Physiology (0826- 307)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course describes the animal ecosystem, community and population with their main components, dynamics and interrelationships. It identifies the effects of non- living factors upon the living organisms of an ecosystem. The course also defines the different patterns of animal behavior. It describes the physiological bases controlling behavior and gives an overall review of the most acknowledged theories of evolution and behavior.

Course Outcomes

After the completion of this course, the student will be able to:

1. Identify an ecosystem with its main a biological and biological components.
2. Recognize population structure ecology such as age and sex.
3. Define different theories that interpret the evolution of different patterns of behavior.
4. Enumerate different biological biomes.
5. Interpret various patterns of animal behavior.
6. Demonstrate the ability to understand the ecosystem with its biological components

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	P.J. Morin. Community Ecology. Blackwell Science. 2nd edition. (2011).							
References	C. Krebs. Laboratory manual of ecological methodology, Univ. of British Columbia, (1989).							

<table>
<tr><td>Course Name</td><td colspan="3">Animal Ecology and Behavior Lab</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-417</td><td>0826417</td><td>8</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Course Track</td><td colspan="6">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
This course covers some lab experiments on ecological factors, conduct different methods to study animal communities and population and analysis the obtained data and also some the different patterns of animal behavior.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define some physical properties of water.
2. Define some Chemical properties of water
3. Recognize of some climatic factors as temperature and humidity.
4. Carry out some lab experiments on animal behavior.
5. Employ a variety of techniques to study animal behavior.
6. Perform some lab experiments, conduct different methods to study some climatic factors and analysis the obtained data.
7. Prepare some lab experiments on animal behavior.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td></td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>50%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">C. Krebs. Laboratory manual of ecological methodology, Univ. of British Columbia, (1989).</td></tr>
<tr><td>References</td><td colspan="7">P.J. Morin. Community Ecology. Blackwell Science.2nd edition. (2011).</td></tr>
</table>

Course Name	Immunology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-408	0826408	8	2	Animal Physiology (0826307)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course provides the basic knowledge and ability to give the student a broad understanding of the immune system and its functions. Topics include terminology, history and fields of immunology. It also provides basic concepts of immune responses, vaccines and vaccination and different immunological disorders.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall the key components of the innate and acquired immune systems and their effector functions.
2. Recognize the mechanisms of immune responses.
3. Summarize immune responses to self- and non-self-antigens.
4. Show independent thinking and demonstrate self-esteem.
5. Demonstrate appraisal of available information in immunology its applications.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	MBBS. Abul Abbas, A. H. Lichtman, S. Pillai. Basic Immunology, 5th Edition. (2016).							
References	A. K. Abbass, and A. H. Lichtman,.Cellular and Molecular Immunology, Elsevier. 6th Edition. (2014).							

Course Name	Immunology Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-418	08260464	8	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course provides students with basic knowledge and ability to different experimental techniques in the field. Topics include : handling, treatment and dissection of experimental animals, commonly used immunological techniques for disease diagnosis, which train them to perform basic research.

Course Outcomes

After the completion of this course, the student will be able to:

1. Memorize different immunological techniques and their applications.
2. Recognize mechanisms of immunological techniques and applications.
3. Show independent thinking and self-esteem.
4. Demonstrate ability to write a report in accordance with the scientific standards.
5. Perform basic research through employing knowledge in handling, drug administration and sample collection.

Assessment Policy	Assignment		Quiz		Lab		Project	
	Midterm	20%	Final	40%	Others (Reports)	40%		
Textbook	F. C.Hay, and O M.R. Westwood. Practical Immunology, Blackwell Science. 4th Ed, (2008).							
References	Clinical & Experimental Immunology Journal							

Course Name	Economic Botany				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 409	0826409	8	2	Plant Taxonomy and Flora (0826302)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course introduces the importance of secondary metabolites produced from different plants. Topics that will be covered include the secondary metabolites and the use of plants as medicines, food, beverages, and textiles. The course will also explore the use of plants in ornamental gardening.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the different categories of economic plant species.
2. Recognize extraction processes of secondary metabolites, uses and economic importance of different plants.
3. Justify the importance of plant secondary metabolites.
4. Apply knowledge and know how to select Economical potential plant..
5. Assess the potential use of software, websites and data shows for academic reports and presentations.

Assessment Policy								
	Assignment	5 %	Quiz	25 %	Lab		Project	
	Midterm	20 %	Final	40 %	Others (Report)	10 %		
Textbook	S. L. Kochhar. Economic Botany: A Comprehensive Study. Cambridge University Press, 5th edition, (2016).							
References	Lewis, W. H., and M. P. F. Elvin-Lewis. Medical botany: plants affecting human. Wiley (2005).							

Course Name	Medical microbiology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-410	0826410	8	2	Applied Microbiology (0826404)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course will introduce students to the microbial species that cause human disease. It will cover diseases of the skin, the gastrointestinal- and urogenital tract, the cardiovascular system, the nervous system, and the respiratory tract: pathogens, modes of transmission, symptoms/disease, virulence factors and therapy and discuss current topics including antibiotic resistance, public health threats, and global health.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall principles of medical microbiology.
2. Recognize normal human flora.
3. Define antibiotics classification, mode of action, area of use.
4. Explain Infectious diseases and the modes of transmission, symptoms and therapy.
5. Apply cycles explaining the mechanisms for transmission, virulence and pathogenicity in pathogenic microorganisms.
6. Implement interactive lectures to differentiate between toxins and their mode of action, pharmaceutical uses.
7. Demonstrate and communicate current microbiological problem areas and carry out searches in relevant databases.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	D. GreenWood et. Al. Medical Microbiology: A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control. With student consult Online Access (Greenwood,Medical Microbiology) Churchill Livingstone, (2007).							
References	G.J. Tortora, B.R. Funke and C.L. Case. Microbiology. An Introduction. Pearson Education Limited, (2014).							

Elective Courses

<table>
<tr><td>Course Name</td><td colspan="3">Microbial Genetics</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-320</td><td>0826320</td><td>5</td><td>3</td><td colspan="2">General Microbiology (0826-206)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="7">Course Description
This course covers principles of microbial genetics including, the genetic material of bacteria and its replication, the gene expression and regulation, Natural DNA transfer, transposons, mutagenesis and mechanisms of genetic recombination</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define DNA and RNA in microbes
2. Describe mechanisms of DNA transfer in bacteria
3. Explain the process of genetic expression and recombination
4. Analyze DNA transfer in bacteria and its use in recombination technology
5. Demonstrate responsibility and leadership to attribute to the current developments in microbial genetic and their applications.
6. Communicate the information and findings of genetics and incorporate these findings into the existing body of knowledge in microbial genetics.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">C. Keya. Microbial Genetics, New Delhi TERI (The Energy and Recourses Institue), (2014).</td></tr>
<tr><td>References</td><td colspan="7">https://doi.org/10.1371/journal.pone.0192618</td></tr>
</table>

Course Name	Bioinformatics				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-321	0826321	5 or 8	3	General Biology (0826101)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course covers basic concepts, methods, and tools used in Bioinformatics. Topics include, biological databases accessing, sequence alignment, gene and protein structure prediction, phylogeny, in addition to genomics and proteomics. Students will acquire practical skills using bioinformatics tools and developing basic information by collecting and presenting bioinformatics data and analyze them via specific software.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define data, database and database research used in bioinformatics
2. Describe nucleic acid and protein sequence analysis methods
3. Analyze the sequence of nucleic acid and protein
4. Design phylogenetic trees, genome mapping, assembly and sequence comparison
5. Appraise the information effectively with others.
6. Search the NCBI website to access the genomic information.

Assessment Policy								
	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	J.J. Ramsden. Bioinformatics: An Introduction. Springer-Verlag Berlin Heidelberg. 2nd Edition. (2009).							
References	1. A. Polanski and M. Kimmel. Bioinformatics. Springer-Verlag Berlin Heidelberg. (2007). 2. A. M. Lesk. Introduction to Bioinformatics. Second Edition. Oxford University Press. (2005).							

Course Name	Cell and Tissue Pathology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-322	0826322	5	3	Histology (0826205)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course is devoted to the study of specific and nonspecific responses of cells and tissues of the human body/animals to various unfavorable factors. It describes the changes in organs and tissues, as well as the manifestations and mechanisms of the development of pathological processes of major diseases. Attention is paid to the processes of cellular adaptation, inflammation, repair/compensation of lost function, and neoplasia.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the concepts of pathological anatomy such as cell injury, inflammation, tissue repair, cellular dyspalsia, neoplasia... etc.
2. Describe characteristic gross and microscopic pictures of different pathologic lesions within organ systems and the associated functional disturbances.
3. Memorize the fate and complications of different disease processes.
4. Predict the diagnosis of different diseases based on the underlying gross and microscopic pictures.
5. Differentiate between normal and abnormal cell and tissue structure in specified disease syndromes.
6. Summarize relevant literature and prepare technical reports on aspects of Histopathology.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	V. Kumar, A. Abbas and J. Aster. Robbins Basic Pathology, Saunders/Elseiver, 10th Edition, (2017).							
References	B. Young, et. al., Wheater's Basic Pathology: A Text, Atlas and Review of Histopathology. Elsevier Health Sciences. 5th Edition, (2009).							

<table>
<tr><td>Course Name</td><td colspan="3">Microbial Ecology</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio-323</td><td>0826323</td><td>5 or 8</td><td>3</td><td>General Microbiology 0826-206</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description
This course covers the basic concepts of microbial ecology. Topics include the general characteristics of microbial life and microbes in natural habitats (air, water, soil and symbionts), microbial interactions with other organisms in the ecosystems. Microbial populations, communities and ecosystems, biogeochemical cycles. Brief introduction of methods used in studying microbial ecology. Microbial Interactions Pelagic food webs and eutrophication.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. List the main characters of microbial life in ecosystem.
2. Record the role of microbes in the natural habitats.
3. Analyze the relationship among microbes and other living organisms in terrestrial habitats.
4. Explain the role of microbes in biogeochemical element cycles in nature.
5. Communicate the information effectively with the group with which he works.
6. Research on the internet for the recent in field of microbial ecology.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">L. B. Larry and D. E. Northup. Microbial Ecology. John Wiley & Sons, Inc., (2011).</td></tr>
<tr><td>References</td><td colspan="7">A. I. Laskin and H. Lechevalier .Microbial Ecology.Taylor & Francis (2018).</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="3">Plant-Organism Interactions</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio 324</td><td>0826324</td><td>5 or 8</td><td>3</td><td>Plant Morphology and Anatomy (0826207)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description
This course is designed to allow students to explore the various ways in which organisms can interact with plants and the outcomes of these interactions. The focus is on examination of the physiological, biochemical and genetic basis of these interactions.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. List positive and negative interactions among plants and other organisms.
2. Describe the current hypotheses on how plants and other organisms interact.
3. Explain the physiological and biochemical processes underlying major symbiotic and pathogenic relationships.
4. Develop ideas and concepts on achieving sustainable food production.
5. Show contribution to group through ideas, suggestions and effort.
6. Evaluate research papers on plant-organisms interactions.</td></tr>
</table>

Assessment Policy	Assignment	5%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others (Reports)	5%		

Textbook	1. L. Ben. Principles of Plant-Microbe Interactions. Springer Foundation N and Chadwick D J (2009). 2. S.E. Smith, D. J. Read. Mycorrhizal Symbiosis. Academic Press,(2008). 3. S. Tewari and N. K. Arora. Plant microbe symbiosis: Fundamentals and advances. Springer, (2003).
References	http://www.ppjonline.org/main.html (The Plant Pathology Journal) https://link.springer.com/journal/13199 (Symbiosis Journal)

Course Name	Sustainable Plant Ecology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio 420	0826420	8	3	Plant Ecology (0826401)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course provides data that engage students in sustainability topics. It covers changing in climate, which poses daily changes and challenges in the world's demand for food and plant products. The appropriate management of the crop ecosystem and critical aspects of soil-plant relationships are emphasized. The course focuses on the science and practices associated with sustainable plant production and/or use within managed systems. It also emphasizes on practices and concepts related to reducing environmental impact. The current course includes studies on the role of sustainable plant ecology in solving modern socio-economic problems.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the concept of sustainability and the general patterns of environmental sustainability.
2. Recognize the global ecological problems, causes and consequences as well as the approaches used to sustain and manage soil and plant protection.
3. Explain the role of different environmental factors and human activities in environmental change and sustainability.
4. Show responsibility in achieving tasks.
5. Demonstrate the ability to read, understand and critically analyze data through the usage of computer, network and software packages relevant to sustainable plant ecology.

Assessment Policy								
	Assignment	5%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others (Reports)	5%		
Textbook	I. P. Francisco and F. Velladares. Functional Plant Ecology. The Ecology of Plants. CRS Press, Francis and Taylor Group. 2nd Edition. (2006).							
References	https://link.springer.com/content/pdf/10.1007%2F978-1-4614-7612-2_18-7.pdf (Ecology and the Environment) https://www.sciencedirect.com/science/book/9780124071964 (Sustainability assessment)							

<table>
<tr><td>Course Name</td><td colspan="3">Petroleum Microbiology</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio-325</td><td>0826-325</td><td>5 or 8</td><td>3</td><td>General Microbiology (0826-206)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description:
This course explores microbial activities related to petroleum, microbial metabolism of hydrocarbons aliphatic and cyclic aromatic hydrocarbons under anaerobic and aerobic conditions. Also, this course will be covered physical, chemical and biological factors affecting petroleum degradation. Microbial degradation of petroleum products and use of microorganisms in oil clean-up operations; oil spillage.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Recognize the paraffinic and aromatic components of different kinds of crude oil.
2. Define the roles of biotechnology in biodegradation, bioremediation or cleanup during oil pollution.
3. Implement formation of petroleum from fossils and microfossils.
4. Apply testable hypothesis about the microbial metabolism of hydrocarbons aliphatic and cyclic aromatic hydrocarbons under anaerobic and aerobic conditions.
5. Demonstrate professional attitudes and behaviors towards others.
6. Demonstrate the ability of students to use computers and internet.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">B. Ollivier, and M. Magot. Petroleum Microbiology. ASM Press, (2005).</td></tr>
<tr><td>References</td><td colspan="7">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC309048/</td></tr>
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<tr><td>Course Name</td><td colspan="3">Pest control</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Bio-421</td><td>0826421</td><td>8</td><td>3</td><td colspan="2">Entomology (0826304)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☐Specialized Core ☒ Electives</td></tr>
<tr><td colspan="7">Course Description
The present course covers a wide range of topics related to pest control including cultural, mechanical, biological and chemical control of pests. In addition, it covers control of common medical and agricultural pests such as insects, mites, nematodes, snails, slugs, mice and birds.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the related basic scientific principles and techniques of pest control
2. Describe the damage that caused by different pests.
3. Design suitable program for pest control
4. Compare between different methods of pest control.
5. Search for suitable models of integrated pest management.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="7">H. F. Van Emden. Pest and vector control. Cambridge University Press, (2004).</td></tr>
<tr><td>References</td><td colspan="7">Journal of biological control.
Journal of stored products.</td></tr>
</table>

Course Name	Animal Biotechnology				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Bio-422	0826422	8	3	Molecular Biology (0826305)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course will cover topics including an introduction to the application of biotechnology to animals, challenges facing the intensive and extensive livestock industries, as well as wildlife management and conservation. Debated in the context of biotechnologies that may be applied. The contribution of biotechnology to laboratory animal models for human and animal disease will be addressed. A range of genetic, immunological and reproductive technologies in industry will be introduced.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall the structure of animal genes and genomes, with emphases on the function genomic and proteomic as well as gene expression and regulation.
2. Define gene therapy-types, approaches and applications of gene therapy.
3. Implement the principles of different techniques used in Animal Biotechnology to address gene transfer, human therapeutic cloning, and stem cell.
4. Evaluate the impact of stem cells in pharmaceutical biotechnology and the application of immunology in animal biotechnology.
5. Demonstrate responsibility for understanding applications of biotechnology.

Assessment Policy	Assignment	10%	Quiz	25%	Lab		Project	
	Midterm	25%	Final	40%	Others			
Textbook	A. S. Verma and A. Singh. Animal Biotechnology-Models in Discovery and Translation , Elsevier,1st Edition, (2014).							
References	R. G. Michael and J. Sambrook. Molecular Cloning: A Laboratory Manual Cold Spring Harbor Laboratory Press, 4th Edition, (2012).							

<table>
<tr><td>Course Name</td><td colspan="3">Applied Botany</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Bio 423</td><td>0826423</td><td>8</td><td>3</td><td>Plant Physiology (0826306)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description
This course introduces the students to many areas of plant applications such as production of natural products under stress, bio-fertilizers, biofuel and bio-pesticides. Also, students will be informed about biomonitoring and phytoremediation of environmental pollution. Basic principles of seed quality and seed production are addressed and study of gene manipulation in plants, plant breeding as well as modern farming practices like hydroponic is also covered in the course.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Identify the effect of stress on plants and roles of natural product as biofertilizers, bioherbicides, biopesticides and biofuel.
2. Recognize the principles, methods and applications of seed technology, plant breeding, genetically modified plants, hydroponic, biomonitoring and phytoremediation.
3. Explain the natural products in stress tolerant plants and their uses as herbicides, pesticides and for production of biofuel.
4. Differentiate between methods and applications in seed technology, plant breeding, gene manipulation of plants, hydroponic, biomonitoring and phytoremediation.
5. Show the sense of responsibility in the working group through suggestion of presentation topics and ideas.
6. Communicate the update knowledge concerning the course demand using internet.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>5%</td><td>Quiz</td><td>25%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2"></td></tr>
<tr><td>Midterm</td><td>25%</td><td>Final</td><td>40%</td><td>Others (Reports)</td><td>5%</td></tr>
<tr><td>Textbook</td><td colspan="8">1. B.D. Singh. Plant Breeding: Principles and Methods. Kalyani, (2007).
2. A. M. Deshmukh, R. M. Khobragade and P. P. Dixit. Handbook of Biofertilizers and Biopesticides. Oxford Book Company, (2007).</td></tr>
<tr><td>References</td><td colspan="8">N. T. Nguyen, S. A. McInturfand, D. G. Mendoza-Cózatl. Hydroponics: A Versatile System to Study Nutrient Allocation and Plant Responses to Nutrient Availability and Exposure to Toxic Elements. Journal of visualized experiments, 113, (2016).</td></tr>
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