Course code: BIOL 2265

Course Title: Fundamentals of Microbiology

Number of Credits: 3

Level: Undergraduate – Year II

Semester: 2

Pre-requisites: Either BIOL1262 Living Organisms I and BIOL1263 Living Organisms II or BIOL1261 Diversity of Organisms or (BIOL1065 Diversity of Plants and Animals and AGRI1012 Microbiology) and either BIOL1362 Biochemistry I and BIOL1364 Genetics I or BIOL1061 Cell Biology and Genetics.

Anti-requisites: BIOL2263 General Microbiology

Course description

Significance/rationale
Microbiology is one of the core sub-disciplines of biology. Microorganisms have been on earth for billions of years and have influenced the physical and chemical conditions necessary for the evolution of higher forms of life. They represent by an unimaginably long distance the largest biological diversity on earth and their activity is essential to the survival of humans on earth. Although some microbes are responsible for human, animal and plant diseases they contribute positively to human welfare as they play critical roles in food & agriculture, industry, medicine and the environment. This course covers an overview of the biology, taxonomy and phylogeny of the archaebacteria, eubacteria, fungi and viruses. Bacterial genetic recombination, growth, nutrition as well as carbon and energy metabolism will be covered. Additional topics include traditional and molecular based methods used in analytical and diagnostic microbiology.

Purpose of Course:
The course provides fundamental training in theoretical and practical microbiology as part of the major in biology in the Department of Life Sciences, UWI, St. Augustine. The course will also be useful to students who may have an interest in other disciplines which have microbiological applications such as environmental biology and ecology, remediation technology, microbial natural product chemistry, biotechnology, biochemistry, medicine. This course will also serve as
the prerequisite for the more specialized Level III courses in microbiology and related disciplines including microbial biotechnology and the courses in the minor programme in microbiology.

**Instructor Information**
BIOLXXXX will be managed by a course coordinator and would be taught be a team of experienced lecturers, supported by a Teaching Assistant/Instructor and laboratory demonstrators. Office hours for the coordinator and lecturers are posted on the faculty bulletin boards and are available from the Department of Life Sciences’ general office. Team members can also be contacted via e-mail.

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E-mail:
Office location:
Office hours:
Phone: 662-2002 Ext.

**Letter to students**
Welcome to BIOL-XXXX- Fundamentals of Microbiology. This course covers the fundamental biology of major groups of microorganisms including bacteria, fungi and viruses. Significant attention is also placed on covering the basic methods used in microbiology. The course is taught through a series of 18 lectures, 12 tutorials and 12 hours of labs. The course is quite extensive and students must make a sincere effort to do well. It is important to attend lectures in order to benefit from more in depth analysis and details that cannot be gained from downloading and reading the PowerPoint and video presentations of the lectures. Please make use of supplementary information provided to strengthen foundation and enhance understanding of material covered.

**Content:**
BIOLXXXX covers the following content:

- Microbial diversity
- Microbial growth and nutrition
- Bacterial genetic recombination
- Fungi
- Viruses
- Carbon and energy metabolism of chemotrophs
- Bacterial photosynthesis
- Control of microorganisms
- Enumeration of microorganisms
Biochemical and molecular identification of microorganisms
Immunology and serology
Microbial ecology

Course goal:
The goal of the course is to provide student with general knowledge on the biology of microorganisms and develop basic practical skills used in their study.

General Objectives:
Students completing the course will have:
1. A fundamental understanding of the diversity, taxonomy, physiology and genetics of bacteria, fungi and viruses;
2. Basic practical skills used in microbiology
3. An understanding of the means to controlling microorganisms

Learning objectives:
Upon completing this course, students will be able to
- describe the general features of microbial diversity and structure and function of prokaryotic and eukaryotic cells;
- review of diversity and importance of microorganism to humans and environment;
- differentiate and identify major taxonomic groups of fungi and fungal-like organisms based on morphology, nutrition, reproduction and ecology;
- describe the general structural, genetic and reproductive characteristics of viruses
- describe the general characteristics and life cycles of named bacteriophages and animal viruses;
- describe the general characteristics of the HIV virus;
- explain how the virus affects humans in causing AIDS as well as how the disease is managed;
- explain the different ways by which genetic changes can take place in bacteria;
- explain the function of different types of culture media;
- explain carbon and energy metabolic processes of microbes;
- compare and contrast carbon and energy metabolism between chemoheterotrophs and chemoautotrophs;
- compare and contrast chemotrophic and phototrophic respiration;
- explain how intrinsic and extrinsic factors affect microbial growth and activity;
- describe the mechanisms used by microorganisms to survive harsh/extreme conditions;
- describe the typical bacterial growth curve and explain the processes influencing and/or taking place at each phase;
- explain how growth process can be controlled under continuous culture conditions;
- explain how microbial cultures can be isolates and purified;
- describe the different way to control microorganisms;
- explain the effect of different control factors on microbial cells;
- explain how the effectiveness of disinfectants can be assessed;
- explain the principles of classifying and naming microorganisms using conventional and current taxonomic tools;
- explain the differences between Eubacteria and Archaebacteria;
- compare and contrast the different methods use in enumerating microorganisms;
- describe and explain the interactions of among microorganisms and between microorganisms and other forms of life;

Mode of Delivery:

Lectures -18 hours: Didactic; interactive
Tutorials -12 hours: Interactive; mind maps; problem-solving
Laboratory classes- 12 hours
(4 three- hour sessions): Interactive practical tasks; problem-solving

ASSIGNMENTS:
Coursework for BIOLXXX will be assigned as follows:

1. Writing across curriculum exercises-5%.
   These activities are designed to encourage students to become active learners by engaging knowledge to further develop understanding. The exercises would help students understanding content and expressing ideas. A total of five simple exercises worth a total of 5 marks (1 mark per exercise) would be given during lectures or tutorials (no more than one per week). Each exercise would take between 5 – 10 minutes to complete and would comprise of varying activities including:
   a. Focused free-writing- Students may be asked to briefly write on their understanding or perspective on a subject/topic covered or on how the subject/topic may be connected to other situations.
   b. Entry slips- Short responses to questions posed at the beginning of class;
   c. Answering questions. One or few questions would be given which students must answer and submit for grading.
   d. Short summary. Students are asked to summarize main points of a reading assignment in a short paragraph.
   e. Group presentation- The tutorial class would be divided into groups and each group would be required to make a short presentation on a document provided.
   f. Complete the life cycle: Students are asked to complete the life cycle diagram given to demonstrate their knowledge of the sequence of events and structures which occur in the microbial organism’s life cycle.
   g. Construction of dichotomous key: Students are asked to construct a dichotomous key to which can be used to key out (identify) a group of specimens.
   h. Reflective statement: students should write a reflective statement on one of the labs completed: students should identify problems encountered, techniques mastered or improved, what was done well and why and what was learnt and what is unclear.
2. **In-course Test-20%**
   One written in-course test would be given worth 10% per test in week 7. Two online tests will also be given in weeks 4 and 11 work 5% each. The tests would comprise of MCQs and structured questions.

3. **Laboratory reports-20%**
   Students are required to submit two full lab reports worth 4% each in addition to four completed worksheets worth 2 mark each. Two lab quizzes would also be given during the 2nd and 4th practical sessions. Each lab quiz would worth 2 marks each.

4. **Class participation- 5%**
   Student participation in tutorial sessions will be monitored by the tutor and a grade assigned at the end of the semester. Participation shall include more than just showing up at tutorial – some evidence of an active role in the tutorial discussion would be required to obtain the full 5% for participation. At the beginning of the semester, the students in each tutorial would engage in developing the exact assessment criteria for this assignment, and the student-developed criteria will be used to determine each student’s participation grade.

Cheating, including plagiarism, would not be tolerated. Incidents of cheating would be dealt with according to UWI’s rules and regulations including:


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**Assessment:**

**Course Work: 50%**
- Writing across the curriculum; critical thinking exercises 5%
- Incourse test 10%
  - One written tests
- Practical exercises
  - Laboratory reports
    - (2 full reports X 4% and 4 worksheets X 2% ) 16%
  - Laboratory quizzes (2 X 2%) 4%
- Tutorial Attendance and participation 5%

Final Semester Examination: 50%
- One 2-hour comprehensive written paper comprising of
  - 35 MCQs worth 35% of paper
  - 5 short answer questions worth 35% of paper
  - 1 essay-type question worth 30% of paper
  - All questions in this paper shall be compulsory

EVALUATION: BIOLXXXX will be evaluated in two ways – (a) through the offices of the Class Representative and the Life Sciences Student-Staff Liaison Committee, and (b) an end of semester course evaluation survey. The class will elect four class representatives (one per lab stream), whose role is to act as a mediator between the Life Sciences academic staff and the students in the class. The representatives will attend Liaison Committee meetings (held at least twice per semester), where they will present feedback on the course to the Department for action. The UWI performs a course evaluation survey at the end of every semester, and this information will also be used for overall assessment of the course and guide possible actions for improvement in subsequent semesters.

TEACHING STRATEGIES: A combination of teaching strategies will be adopted in BIOLXXXX.
The primary teaching strategy will be based on the face to face classroom lectures and discussions. Videos of lecture presentations would be made available to students prior to the lecture session via podcast media. Students are advised to view these videos before the lecture so that more emphasis can be placed on discussions and answering questions, thereby facilitating deep learning. This would also afford the time to have assessment exercises on “writing across the curriculum”. MyeLearning will be utilized throughout the course as a means to provide access to course materials such as Powerpoint presentation files, animations, weblinks, lessons and quizzes. This medium would also be used as a portal for student-lecturer communications and the dissemination of coursework feedback.

A total of 12 tutorial sessions would be given for the semester. These would be small group sessions which would be conducted by instructors or tutors, who would normally by senior postgraduate students in Life Sciences. Students must attend tutorial sessions. Tutorials sheets will be assigned prior to each session via myeLearning, and students are expected to attempt the solutions before coming to tutorial. The goal of the tutorial session is to give students a more hands-on experience with the course material and easier access to course instructors. Students will be expected to ask and answer questions on material that is unclear, propose solutions to questions on the tutorial sheet and to generally participate fully in the tutorial activities. Tutors will not merely be going through the answers to the tutorial questions in these sessions.
Practical sessions would include demonstrations and problem solving exercises to develop practical skills and enhance understanding of content covered in the theory section. These exercises would include analysis of specimens, experiments and use of identification keys to assign organisms into different levels of taxa.

In order to pass the course, you must gain an overall passing mark of 40%. Any student who misses more than 25% of practical classes or tutorial sessions without a medical or other valid excuse can be debarred from writing the final exam.

RESOURCES:
Text books:

Suggested additional readings:
- Madigan, M and Martinko, J (2005), Brock Biology of Microbiology (Eleventh Edition), Prentice Hall, New Jersey

Teaching materials:
- Electronic copies of presentations as well as supplementary handouts will be made available to students;
- Internet links to web-based resources will be provided to students

Lab coat:
- Each student should have suitable Lab coat to use for practical exercises. Students not having lab coats will not be permitted in the lab.

COURSE CALENDAR/SCHEDULE:
Introduction and review
Microbial growth and nutrition
Fungi
Viruses
Carbon and energy metabolism of chemotrophs
Bacterial photosynthesis
Control of microorganisms
Bacterial genetic recombination
Enumeration of microorganisms
Biochemical and molecular identification of microorganisms
Immunology and serology
Microbial ecology

**Course calendar:**

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<thead>
<tr>
<th>Week</th>
<th>Practical exercise</th>
<th>Lecture/Tutorial</th>
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| 1    |                    | Lecture 1: Introduction; microbial diversity and importance to humans and the environment  
      |                    | Lecture 2: Microbial growth and nutrition  
      |                    | Tutorial 1: |
| 2    |                    | Lecture 3: Fungi and fungal-like organisms  
      |                    | Tutorial 2: |
| 3    | Review of basic aseptic and microbiological methods  
      | Isolation of bacteria and partial establishment of Koch’s Postulates  
      | Staining and microscopic examination of bacteria  
      | Morphological diversity of bacteria | Lecture 4: Fungi and fungal-like organisms  
      | Lecture 5: Viruses  
      | Tutorial 3: |
| 4    |                    | Lecture 6: Viruses  
      |                    | Tutorial 4:  
      |                    | *Online test: MCQs (5%)* |
| 5    | Lab quiz based on previous session  
      | Isolation and Enumeration of fungi  
      | Observation and morphological identification of Fungi  
      | Observation of viral infected plants | Lecture 7: Bacterial genetic recombination  
      | Lecture 8: Bacterial genetic recombination  
      | Tutorial 5: |
| 6    |                    | Lecture 9: Carbon and energy metabolism  
      |                    | Tutorial 6: |
| 7    | Lab quiz based on previous sessions  
      | Enumeration of Identification of bacteria based on biochemical tests | Lecture 10: Carbon and energy metabolism  
<pre><code>  |                    | Tutorial 7: |
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<tr>
<th>Week</th>
<th>Topic</th>
<th>Lecture 1</th>
<th>Lecture 2</th>
<th>Lecture 3</th>
<th>Lecture 4</th>
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<tr>
<td>8</td>
<td>Written in-course test (in lecture slot) – MCQs, structured questions (10%)</td>
<td>Lecture 11: Bacterial photosynthesis</td>
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<td>9</td>
<td>Molecular identification of bacteria, fungi and viruses</td>
<td>Lecture 12: Control of microorganisms</td>
<td>Lecture 13: Biochemical and molecular identification of microorganisms</td>
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<td>10</td>
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<td>Lecture 14: Biochemical and molecular identification of microorganisms</td>
<td>Lecture 15: Immunology and serology 2</td>
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<td>11</td>
<td></td>
<td>Lecture 16: Immunology and serology 2</td>
<td>Lecture 17: Microbial ecology</td>
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<td>12</td>
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<td>Lecture 18: Microbiology ecology</td>
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<td>Online test- MCQs (5%)</td>
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