Miami Dade College

Course Competencies Template - Form 112

GENERAL INFORMATION	
Name: Edwin Ginés-Candelaria	Phone #: (305) 237- 3396
Course Prefix/Number: MCB 2010	Course Title: Microbiology
Number of Credits: 3	
Degree Type	☐ B.A. ☒ B.S. ☐ B.A.S ☒ A.A. ☒ A.S. ☐ A.A.S. ☐ C.C.C. ☐ A.T.C. ☐ V.C.C
Date Submitted/Revised: Spring 2007-2	Effective Year/Term: FALL 2008-1
☐ New Course Competency ☒ Revised Course Competency	
Course to be designated as a General Education course (part of the 36 hours of A.A. Gen. Ed. coursework): ☐ Yes ☒ No	
The above course links to the following Learning Outcomes: ☐ Communication ☒ Numbers / Data ☒ Critical thinking ☒ Information Literacy ☐ Cultural / Global Perspective ☐ Social Responsibility ☐ Ethical Issues ☒ Computer / Technology Usage ☐ Aesthetic / Creative Activities ☒ Environmental Responsibility	
Course Description (limit to 50 words or less, **must correspond with course description on Form 102**): This course introduces basic principles of morphology, physiology, biochemistry and genetics of microorganisms. The students will learn representative types of microorganisms including bacteria, algae, protozoa and viruses and the roles of various microorganisms in health and disease, modes of transmission and the effects of their activities in our biosphere. Students are strongly recommended to take the laboratory component MCB 2010L.	
Prerequisite(s): BSC-2010/L or BSC-2085/L; CHM-1033/L or CHM 1045/L.	Corequisite(s):

Course Competencies: (for further instruction/guidelines go to: http://www.mdc.edu/asa/curriculum.asp)

Competency 1: The student will be able to demonstrate knowledge of the history and the scope of Microbiology, in terms of contribution of various scientists to different branches of Microbiology, and the contribution of microorganisms to our environment and natural processes by:

1. Summarizing the history of the development of Microbiology and the contribution of various pioneers in this field.
2. Listing the relevant characteristics of each of the five groups of microorganisms.
3. Explaining the two opposing theories of the origin of Microorganisms: Spontaneous Generation and Biogenesis.
4. Explaining the Germ Theory of Disease.
5. Evaluating the contributions of different scientists to the field of microbiology and disease prevention.

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6. Listing the roles played by microorganisms on Earth.

Competency 2: The student will integrate the role of microscopy and staining in the study of microorganisms by:

1. Comparing the different types of microscopy.
2. Explaining the function of the major parts of the microscope.
3. Discussing magnification, resolving power and refraction of microscopes.
4. Discussing the procedure and significance of the Gram stain.
5. Contrasting simple, differential and special staining techniques.
6. Discussing the benefits of observing living microorganisms.
7. Summarizing the applications of microscopy techniques to study microorganisms.

Competency 3: The student will demonstrate knowledge of the structure and functional characteristics of prokaryotic cells by:

1. Comparing prokaryotic and eukaryotic cells.
2. Listing structures of prokaryotic cells.
3. Describing the endosymbiotic theory of the origin of mitochondria and chloroplasts.
4. Describing the formation, function and significance of endospores.
5. Explaining various mechanisms for transport of molecules across the plasma membrane, and group translocation.
6. Discussing the effects of osmosis on microbial control.
7. Contrasting the structures of the cell wall of Gram-positive, Gram-negative and Acid-Fast cells and their effect on differential staining.
8. Describing the structure and function of the prokaryotic flagellum.

Competency 4: The student will demonstrate knowledge of taxonomy and classification of Microorganisms and its effect on scientific information exchange by:

1. Defining taxonomy, taxa and phylogeny.
2. Discussing the advantages of the three-domain system over other traditional methods to assess the phylogenetic relatedness among microorganims.
3. Discussing the taxonomic hierarchy used in the classification of Prokaryotes and Eukaryotes.
4. Defining binomial nomenclature.
5. Comparing methods used in classifying and identifying microorganisms.
6. Contrasting cladograms and dichotomous keys.
7. Explaining the main objectives of the Bergey's Manual of Systematic and Determinative Bacteriology.

Competency 5: The student will summarize distinct structural and physiological characteristics of the major groups of prokaryotic and eukaryotic microorganisms by:

1. Comparing features common to microbes in the domain *Archaea*, domain Bacteria and domain Eukarya.
2. Discussing the major groups of Bacteria.
3. Describing the major groups of *Archaea*.
4. Comparing the major groups of Fungi and Protists.
5. Listing the major groups of eukaryotic parasites.

Competency 6: The student will demonstrate knowledge of the importance and complexity of metabolic reactions in Microorganisms by:

1. Discussing the role of ATP in anabolism and catabolism.
2. Discussing the role of enzymes in biochemical reactions and metabolic pathways.
3. Discussing factors that affect enzyme activity.
4. Defining oxidation, reduction and dehydrogenation reactions in biological systems.
5. Contrasting the three types of phosphorylation reactions generating ATP.

6. Discussing the three stages of glucose catabolism and the production of ATP.
7. Discussing the fate of the carbon atoms in a molecule of glucose during aerobic respiration.
8. Listing the types of electron carriers in electron transport chains.
9. Describing the role of chemiosmosis in oxidative phosphorylation of ATP.
10. Listing types of fermentation used by microorganisms and the chemical reactions involved.
11. Contrasting aerobic and anaerobic respiration and fermentation in terms of final electron acceptor and ATP production.
12. Describing the use of carbohydrate fermentation as biochemical tests for the identification of bacteria in clinical specimens.
13. Listing how lipids and proteins are catabolized via the TCA cycle.
14. Defining Phototrophs, Chemotrophs, autotrophs and heterotrophs.
15. Recognizing the major anabolic pathways in organisms.
16. Discussing the importance of amphibolic pathways in linking catabolism and anabolism.

Competency 7: The student will demonstrate knowledge of microbial growth by:

1. Describing the chemical and physical requirements for microbial growth and reproduction.
2. Describing and differentiating organisms based on their oxygen requirements.
3. Discussing the different toxic forms of oxygen.
4. Explaining how organisms protect themselves from toxic forms of oxygen.
5. Comparing the different pure culture techniques.
6. Comparing the types of general and special culture media and methods available to establish cultures of microorganisms.
7. Reviewing the methods for preserving microorganisms.
8. Explaining the bacterial growth curve.
9. Contrasting direct and indirect methods for measuring bacterial growth.

Competency 8: The student will integrate principles in the control of microbial growth, and the effects on microbial physiology by:

1. Differentiating between antisepsis, disinfection, and sterilization.
2. Discussing the factors affecting the efficacy of an antimicrobial control method.
3. Contrasting the methods used for the evaluation of disinfectants and antiseptics.
4. Explaining the mode of action of antimicrobial agents used for control of microbes in the environment.
5. Comparing the physical methods of microbial control.
6. Explaining the principle of selective toxicity.
7. Explaining the mechanisms of action antimicrobial chemotherapeutic agents used for infectious diseases.
8. Distinguishing between narrow-spectrum and broad-spectrum chemotherapeutic agents in terms of targets and side effects.
9. Comparing Kirby-Bauer, E-test, MIC, and MBC tests.
10. Discussing the clinical considerations in prescribing antimicrobial drugs.
11. Discussing drug resistance in terms of the mechanisms involved and how it can be prevented.

Competency 9: The student will demonstrate knowledge of the flow and control of genetic information within and between cells by:

1. Describing the structure and function of plasmids.
2. Explaining how the genotype of an organism determines its phenotype.
3. Describing the central dogma of genetics and explaining the roles of DNA and RNA in polypeptide synthesis.
4. Explaining the operon model of transcriptional control in prokaryotes.
5. Defining mutation.
6. Comparing types of point mutations.
7. Discussing how different types of mutagenic agents increase mutation frequencies.

8. Describing chemical mutagens and their effects on cells.
9. Contrasting the positive and negative selection techniques for isolating mutants.
10. Describing the Ames test and discussing its utility in the identification of mutagens.
11. Comparing the various DNA repair mechanisms.
12. Defining genetic recombination.
13. Contrasting vertical with horizontal gene transfer mechanisms in bacteria.
14. Explaining how gene transfer in bacteria contributes to antibiotic resistance.
15. Describing the structures and actions of simple and complex transposons.
16. Explaining how gene transfer mediated by transposons contributes to antibiotic resistance.

Competency 10: The student will demonstrate knowledge of the principles of recombinant DNA technology by:

1. Defining recombinant DNA technology.
2. Describing common tools and techniques used in Biotechnology.
3. Describing the Polymerase Chain Reaction (PCR) and the various contributions of PCR to the field of microbiology.
4. Listing various application of recombinant technology.
5. Discussing the safety and ethical concerns regarding gene manipulation using recombinant technology.

Competency 11: The student will demonstrate knowledge of acellular microbes such as viruses, viroids, and prions by:

1. Describing the general structural and morphological characteristics of viruses.
2. Listing the various methods for culturing and propagating viruses.
3. Discussing the lytic and lysogenic replication cycles of bacteriophages.
4. Describing the various strategies for viral genome replication.
5. Comparing bacteriophage and animal virus genome replication strategies.
6. Defining the process of budding and its relationship to enveloped viruses.
7. Defining latent and persistent viral infections.
8. Defining oncogenesis and the relationship between viruses and cancer.

9. Discussing the mechanisms by which Prions cause diseases.
10. Contrasting viroids, prions and viruses.

Competency 12: The student will demonstrate knowledge of pathogenic mechanisms in microorganisms and their roles in infectious disease by:

1. Listing portals of entry and exit for infectious microbes.
2. Defining Infectious dose (ID_{50}) and Lethal dose (LD_{50}).
3. Listing pathogenic mechanisms that allow microbes to penetrate host defenses.
4. Describing pathogenic mechanisms in bacteria and viruses that damage host cells.

Competency 13: The student will demonstrate knowledge of the principles of disease and epidemiology by:

1. Defining infection and disease.
2. Describing normal and transient microbiota.
3. Explaining symbiotic relationships between microbiota and their hosts.
4. Listing Koch's postulates and their limitations.
5. Differentiating the classification schemes used to classify infectious diseases.
6. Explaining stages of the disease process.
7. Listing reservoirs and methods of transmission of infectious microbes.
8. Discussing Nosocomial infections and their control.
9. Defining emerging infectious diseases.
10. Discussing the applications of Epidemiology.

Competency 14: The student will demonstrate knowledge of host defense mechanisms against infectious diseases by:

1. Listing the non-specific defense mechanisms in the human body.
2. Defining innate versus adaptive immunity.

3. Discussing the mechanism employed by pathogens to evade and or survive phagocytosis.
4. Explaining the components and consequences of complement activation.
5. Defining active versus passive immunity and natural acquired versus artificially acquired immunity.
6. Listing components of Humoral versus cellular immunity.
7. Discussing five classes of antibodies and their functions.
8. Defining the various classes of T cells and their functions.
9. Contrasting the different types of hypersensitivity reactions.