



Purpose: It is the intention of this Administrative-Master Syllabus to provide a general description of the course, outline the required elements of the course and to lay the foundation for course assessment for the improvement of student learning, as specified by the faculty of Wharton County Junior College, regardless of who teaches the course, the timeframe by which it is instructed, or the instructional method by which the course is delivered. It is not intended to restrict the manner by which an individual faculty member teaches the course but to be an administrative tool to aid in the improvement of instruction.

Course Title - Microbiology

Course Prefix and Number – BIOL 2420

Department - Biology

Division – Math & Science

Course Type: (check one)

- Academic General Education Course (from ACGM – but not in WCJC Core)
- Academic WCJC Core Course
- WECM course (This course is a Special Topics or Unique Needs Course: Y or N)

Semester Credit Hours # : Lecture hours# : Lab/other hours # 4:3:2

Equated Pay hours for course – 4.2

Course Catalog Description – Study of the morphology, physiology, and taxonomy of representative groups of pathogenic and nonpathogenic microorganisms. Pure cultures of microorganisms grown on selected media are used in learning laboratory techniques. Includes a brief preview of food microbes, public health, and immunology.

List Lab/ Other Hours
Lab Hours 2
Clinical Hours
Practicum Hours
Other (list)

Prerequisites/Corequisites - TSI satisfied in reading and writing; BIOL 1406 or BIOL 2401 with a grade of “C” or better.

Approvals – *the contents of this document have been reviewed and are found to be accurate.*

Prepared by Kim Raun and Candy Doriski

Date 9/12/11

Reviewed by department head Kim Raun

Date 9/12/11

Accuracy verified by Division Chair Kevin Dees

Date 10/10/2011

**Approved by Dean of Vocational Instruction
or Vice President of Instruction** Leigh Ann Collins

Date 12/01/11



I. Topical Outline – Each offering of this course must include the following topics (be sure to include information regarding lab, practicum, clinical or other non lecture instruction):

Lecture Outline

- I. Introduction to Microbiology
 - A. Microbial Dimensions and Major Groups of Microbes
 - B. Importance of Microbes
- II. History of Microbiology
 - A. Leeuwenhoek and Simple Microscope
 - B. Pasteur and Germ Theory
 - C. Lister and Aseptic Technique
 - D. Koch, Lab Advances and Koch's Postulates
- III. Theories
 - A. Miasmatic Theory
 - B. Germ Theory of Disease
 - C. Cell Theory
 - D. Theory of Evolution
- IV. Taxonomy
 - A. Scientific Name
 - B. Taxonomic Levels
 - C. Domain Eukarya, Bacteria, and Archaea
 - D. Dichotomous Key
- V. Characteristics of Life
- VI. Prokaryotic Cells
 - A. Shapes and Arrangements
 - B. Bacterial Cell Structure
 - 1. Appendages: flagella, fimbriae, pili
 - 2. Glycocalyx: slime layer, capsule
 - 3. Cell Envelope: cell wall, gram-positive vs. gram-negative, cell membrane, mesosomes
 - 4. Cytoplasm: genetic material, plasmid, ribosome, inclusion, cytoskeleton
 - 5. Special Cases: acid-fast walls, pleomorphic Mycoplasma
 - 6. Endospores
 - C. Archaea: unique structure, primitive extremophiles
- VII. Microbial Growth & Ecology
 - A. Binary Fission
 - B. Single-celled Population Growth: calculating population size, generation time
 - C. Growth Curve
 - D. Factors Affecting Growth
 - 1. Temperature: cardinal range, optimum T, psychrophiles, mesophiles, thermophiles
 - 2. Gas: aerobes, facultative anaerobes, obligate anaerobes, aerotolerant, capnophiles
 - 3. pH: acidophiles, alkaliphiles
 - E. Symbiosis: mutualism, commensalism, parasitism
- VIII. Eucaryotic Cells & Microorganisms
 - A. Fungi
 - 1. Characteristics: heterotrophic, chitin cell wall
 - 2. Morphological Forms: yeast vs. mold; budding, hyphae, spores, dimorphism
 - B. Protists
 - 1. Algae: photosynthetic, red tides
 - 2. Protozoa: heterotrophic, single-celled, contractile vacuoles, cilia, flagella, pseudopodia, trophozoite, cyst
 - C. Helminths

1. Characteristics & Parasitic Adaptations
 2. Life Cycles & Infection Routes
- IX. Viruses
- A. Characteristics: intracellular obligate parasites, non-living
 - B. Structure: capsid (helical vs. icosahedral), envelope, variety of genetic material, spikes
 - C. Complex Viruses: poxviruses, bacteriophages
 - D. Classification: family and genus names
 - E. Viral Multiplication: adsorption, penetration, synthesis, assembly, release
 1. Bacteriophages: lytic cycle vs. lysogenic cycle, temperate phage, prophage, lysogeny
 2. Animal Viruses: naked vs. enveloped, membrane fusion, uncoating, provirus
 3. Plant Viruses
 - F. Medical Uses of Viruses: vaccines, gene therapy, control of bacterial infections
 - G. Other Noncellular Infectious Agents: viroids, prions
- X. Microbial Metabolism
- A. Anabolism vs. Catabolism
 - B. Activation Energy, Reaction Rate, Biological Catalysts
 - C. Enzyme Structure: 3-D conformation, active site, holoenzyme, apoenzyme, cofactor
 - D. Inhibition: competitive, allosteric, feedback, genetic regulation
 - E. Energy Strategies: aerobic respiration, anaerobic respiration, fermentation, photosynthesis
- XI. Microbial Genetics
- A. Function of DNA: heredity, control of protein synthesis and traits
 - B. Structure of DNA: double helix, nucleotides, complementary base pairing, packaging
 - C. Terms: genome, chromosome, gene, plasmid
 - D. DNA Replication: purpose, semi-conservative model, accuracy, role of key enzymes
 - E. RNA: structure, types, codon, anticodon
 1. Transcription
 2. Translation
 - F. Genetic Variation
 1. Mutation
 2. Genetic Recombination: conjugation, transformation, transduction
 3. Antibiotic Resistance
- XII. Genetic Engineering
- A. Recombinant DNA Technology
 - B. Genetic Treatments
 - C. Genome Mapping and Screening
- XIII. Control of Microbial Growth
- A. Terms: disinfect, sterilize, disinfectant, antiseptic, selectively toxic, narrow vs. broad spectrum antibiotics,
 - B. Physical Methods: heat, filtration, radiation, ultrasonic vibrations
 - C. Chemical Methods: halogens, phenolics, alcohols, H₂O₂, alkylating agents, detergents, soaps, heavy metals
 - D. Drugs: penicillins, cephalosporins, vancomycin, bacitracin, polymyxins, fluoroquinolones, rifampin, aminoglycosides, tetracyclines, macrolides, chloramphenicol, sulfonamides, polyenes, azoles, echinocandins, flucytosine, quinine, antivirals, interferon
- XIV. Disease Process
- A. Concepts: infection vs. disease, normal flora (resident/transient), microbial antagonism
 - B. Stages of Infection: incubation, prodromal, illness, convalescence
 - C. Patterns of Infection: local, systemic, focal, primary, secondary, acute, chronic, latent, subclinical
 - D. Terms: symptoms, signs, syndrome
 - E. Epidemiology: reservoirs, carriers, zoonoses, communicable, contagious, non-communicable, direct transmission, indirect transmission, fomites, nosocomial, morbidity, mortality, sporadic, endemic, epidemic, pandemic,
- XV. Host Defenses
- A. First Line of Defense: physical, chemical, genetic barriers
 - B. Second Line of Defense: inflammation, phagocytes, interferon, complement
 - C. Third Line of Defense: specific immunity
 1. Humoral response
 2. Cell-mediated response

3. Immunity: active, passive, natural, artificial

Lab Outline

- I. Lab Safety
 - A. General Safety Guidelines
 - B. Handling Live Bacteria
- II. Basic Microscopy
 - A. Type of Microscopes
 - 1. Light Microscopes: simple and compound
 - 2. Electron Microscopes: transmission and scanning
 - B. Structure and Function of Parts of the Microscope
 - C. Proper Microscopy Technique
- III. Aseptic Technique
 - A. Growth Media: Nutrient Agar vs. SDA - compare types of growth
 - B. Need for Aseptic Technique; Aseptic Technique Practices
- IV. Culturing Microbes & Media Inoculation
 - A. Inoculation, Isolation, Incubation, Inspection, & Identification
 - B. Procedures for Inoculation
- V. Staining
 - A. Negative Staining Procedure
 - B. Smear Preparation and Simple Staining Procedure
 - C. Gram Staining Procedure
 - D. Spore Staining Procedure
 - E. Capsule Staining Procedure
- VI. Eukaryotic Survey
 - A. Fungi
 - 1. Penicillium: conidia
 - 2. Rhizopus: sporangiospores vs. zygospores
 - 3. Candida: dimorphism, yeast, hyphae
 - 4. Saccharomyces: buds and budding
 - B. Protozoa
 - 1. Amoeba: nucleus, pseudopodia
 - 2. Trichomonas: flagella
 - 3. Trypanosoma: flagella, erythrocytes
 - 4. Paramecium: nucleus, cilia
 - 5. Plasmodium: erythrocytes, leukocytes, ring stage
 - C. Helminths
 - 1. Ascaris: male vs. female, spicule
 - 2. Enterobius: female tail, eggs
 - 3. Trichinella: pig muscle tissue, larvae
 - 4. Fasciola: flatworm specimen
 - 5. Taenia: scolex with suckers and hooks, proglottids - immature vs. mature
- VII. Motility
 - A. Flagellar Stain: amphitrichous vs. peritrichous
 - B. Semi-solid: motile vs. non-motile
 - C. Hanging Drop Procedure: true motility vs. Brownian movement
- VIII. Biochemical Tests: catalase, denitrification, H₂S production, indole production, methyl red, O-F tests
- IX. Microbial Control
 - A. Chemical Control: effectiveness of antiseptics and disinfectants
 - B. Antibiotics: lawn, zone of inhibition, narrow vs. broad spectrum, susceptible vs. resistant
- X. Identification of Unknown
 - A. Staining Results: Gram stain
 - B. Culture Characteristics: broth, plate
 - C. Biochemical Tests

II. Course Learning Outcomes

Course Learning Outcome	Method of Assessment
1. Recognize the role of microorganisms in ecology, human health, and commercial and industrial processes.	1. lecture exams
2. Describe the characteristics, structure and function, and reproductive processes of: prokaryotic cells, eukaryotic microorganisms, and viruses.	2. lecture exams and lab practicals
3. Discuss the various theories related to the field of microbiology (both historical and current) including: cell theory, endosymbiotic theory, miasma theory, germ theory, prion theory, and theory of evolution.	3. lecture exams
4. Identify methods used to control microbial growth.	4. lecture exams and lab practical
5. Perform aseptic techniques; grow cultures; and identify microorganisms using culture characteristics, biochemical tests, staining methods, and proper microscopy technique.	5. lab practicals

III. Required Text(s), Optional Text(s) and/or Materials to be Supplied by Student.

Talaro. *Foundations in Microbiology*. McGraw-Hill. Current edition

IV. Suggested Course Maximum - 36 lecture; 24 lab

V. List any specific spatial or physical requirements beyond a typical classroom required to teach the course.

Laboratory classroom with gas outlets and sinks required

VI. Course Requirements/Grading System – Describe any course specific requirements such as research papers or reading assignments and the generalized grading format for the course

Lecture Average:	<u>55%</u>	Grade Assignments (%):
Exam average (3-4 exams)	30-55%	A 100-90
Other (homework, quizzes, projects, etc.)	0-25%	B 89-80
Laboratory Average (average of 2 lab practicals)	<u>25%</u>	C 79-70
Final Exam (includes at least 50% comprehensive material)	<u>20%</u>	D 69-60
Total	100%	F Below 60

VII. Curriculum Checklist

- **Academic General Education Course** (from ACGM – but not in WCJC Core)
No additional documentation needed

- **Academic WCJC Core Course**
Attach the Core Curriculum Checklist, including the following:

- Basic Intellectual Competencies
- Perspectives
- Exemplary Educational Objectives

- **WECM Courses**
Attach the following:

- Program SCANS Matrix
- Course SCANS Competencies Checklist



Page 1: Competencies

Course Prefix & Number: BIOL 2420	
Competency	Method of Assessment
READING: Reading at the college level means the ability to analyze and interpret a variety of printed materials – books, articles, and documents.	lecture exam
WRITING: Competency in writing is the ability to produce clear, correct, and coherent prose adapted to purpose, occasion, and audience.	
SPEAKING: Competence in speaking is the ability to communicate orally in clear, coherent, and persuasive language appropriate to purpose, occasion, and audience.	
LISTENING: Listening at the college level means the ability to analyze and interpret various forms of spoken communication.	lecture exams and lab practicals
CRITICAL THINKING: Critical thinking embraces methods for applying both qualitative and quantitative skills analytically and creatively to subject matter in order to evaluate arguments and to construct alternative strategies.	lecture exams and lab practicals
COMPUTER LITERACY: Computer literacy at the college level means the ability to use computer-based technology in communicating, solving problems, and acquiring information.	



Page 2: Perspectives

Course Prefix & Number: BIOL 2420	
Perspective	Method of Assessment
1. Individual and society/world; cultural and ethnic diversity	lecture exam
2. Individual, political, economic, and social aspects of life; being a responsible member of society	lecture exam
3. Health and wellness	lecture exam and lab practical
4. Technology and science: use and understanding	lab practical
5. Personal values for ethical behavior	lecture exam
6. Ability to make aesthetic judgments	
7. Logical reasoning in problem solving	lab practical
8. Integrate knowledge from and understand interrelationships of the scholarly disciplines	lecture exam



Page 3: Exemplary Educational Objectives

Course Prefix & Number: BIOL 2420	
Component Area: Natural Sciences	
Exemplary Educational Objective	Method of Assessment
1. Understand and apply method and appropriate technology to the study of natural science.	lecture exam and lab practical
2. Recognize scientific and quantitative methods and the difference between these approaches and other methods of inquiry; and communicate findings, analyses, and interpretations both orally and in writing.	lab practical
3. Identify and recognize the differences among competing scientific theories.	lecture exam
4. Demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.	lecture exam
5. Demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.	lecture exam