



**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/Co-requisites** - TSI reading and writing requirements met; BIOL 1406 or BIOL 2401 with a grade of “C” or better.

**Prepared by** Kim Raun

**Date** 8-1-13

**Reviewed by Department Head** Kim Raun

**Date** 8-1-13

**Accuracy Verified by Division Chair** Kevin Dees

**Date** 8-1-13

**Approved by Dean or Vice President of Instruction** *gghunt*

**Date** 8-1-13



**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, H<sub>2</sub>O<sub>2</sub>, 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, H<sub>2</sub>S 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 Outcomes Upon completion of this course, students will:	Methods of Assessment
1. Recognize the role of microorganisms in ecology, human health, and commercial and industrial processes.	1. lecture exams ; presentation, discussion (in-class or Blackboard), essay, research paper, group activity, case study, graph/table/chart
2. Describe the characteristics, structure and function, and reproductive processes of: prokaryotic cells, eukaryotic microorganisms, and viruses.	2. lecture exams and lab practicals; Group activity, discussion (in-class or online), lab report, presentation, graph/table/chart, essay, exam, case study
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; Exam, essay, presentation, project, discussion
4. Identify methods used to control microbial growth.	
5. Perform aseptic techniques; grow cultures; and identify microorganisms using culture characteristics, biochemical tests, staining methods, and proper microscopy technique.	4. lecture exams and lab practical; Group activity, discussion (in-class or online), lab report, presentation, graph/table/chart, essay, exam, case study  5. lab practicals; Lab report*, essay, presentation, project, graph and/or table, exam, case study

## 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
<b>Total</b>	<b>100%</b>	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 Review Forms

- Critical Thinking
- Communication
- Empirical & Quantitative Skills
- Teamwork
- Social Responsibility
- Personal Responsibility

- **WECM Courses**

Attach the following:

- Program SCANS Matrix
- Course SCANS Competencies Checklist



**Core Curriculum Review Form**

Foundational Component Area: **Life & Physical Sciences**

Course Prefix & Suffix: \_\_\_\_\_

Core Objective: **Critical Thinking Skills**—to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

*Student Learning Outcome supporting core objective:*

*For each core objective, there must be at least two different methods of assessment.*

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
<input type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input type="checkbox"/> State Mandated			
<input type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input type="checkbox"/> State Mandated			
<input type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input type="checkbox"/> State Mandated			

Department Head: \_\_\_\_\_

Date: \_\_\_\_\_



**Core Curriculum Review Form**

Foundational Component Area: **Life & Physical Sciences**

Course Prefix & Suffix: \_\_\_\_\_

Core Objective: **Communication Skills**—to include effective development, interpretation and expression of ideas through written, oral and visual communication

*Student Learning Outcome supporting core objective:*

*For each core objective, there must be at least two different methods of assessment.*

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
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Department Head: \_\_\_\_\_

Date: \_\_\_\_\_



**Core Curriculum Review Form**

Foundational Component Area: **Life & Physical Sciences**

Course Prefix & Suffix: \_\_\_\_\_

Core Objective: **Empirical and Quantitative Skills**—to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

*Student Learning Outcome supporting core objective:*

*For each core objective, there must be at least two different methods of assessment.*

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
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Department Head: \_\_\_\_\_

Date: \_\_\_\_\_





**Core Curriculum Review Form**

Foundational Component Area: **Life & Physical Sciences**

Course Prefix & Suffix: \_\_\_\_\_

Core Objective: **Teamwork**—to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

*Student Learning Outcome supporting core objective:*

*For each core objective, there must be at least two different methods of assessment.*

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
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Department Head: \_\_\_\_\_

Date: \_\_\_\_\_