RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC COURSE OUTLINE

MLTC 210 Clinical Chemistry

I. Basic Course Information

A. Course Number and Title: MLTC 210 Clinical Chemistry

B. New or Modified Course: Modified

C. Date of Proposal: Semester: Spring Year: 2022

D. Effective Term: Fall 2022

E. Sponsoring Department: Science & Engineering

F. Semester Credit Hours: 4 credit

G. Weekly Contact Hours: 6 Lecture: 3
Laboratory: 3
Out of class student work per week: 7.5

H. Prerequisites: MLTC 100 with a grade of C or higher and CHEM 102 with a grade of C or higher; or permission of the instructor

I. Laboratory Fees: No

J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval:
Department Chair: Marianne Baricevic, Marianne.baricevic@raritanval.edu
Divisional Dean: Sarah Imbriglio, sarah.imbriglio@raritanval.edu

II. Catalog Description

Prerequisites: MLTC 100 with a grade of C or higher and CHEM 102 with a grade of C or higher; or permission of the instructor. This course is an in depth study of specimen processing, analysis, test interpretation and quality control procedures used in routine manual and automated clinical chemistry testing. It covers the concepts of clinical chemistry as they apply to the renal, digestive, respiratory and endocrine systems, and includes the chemistry of metabolism, protein synthesis, acid-base balance, enzymes and hormones. Homeostasis and disease state results will be analyzed and studied. Labs will include the theory, operation and maintenance of the analytical instruments and tools used to perform routine clinical chemistry tests.

III. Statement of Course Need

A. Clinical chemistry testing and analysis are necessary skills needed for competent MLTs. This course is required for the Medical Laboratory Technology program.

B. There is a lab component in this course so that the theory can be practiced.

C. This course generally transfers as a Free Elective, but it may transfer as a Program Elective to schools that offer a B.S. degree in Clinical Laboratory Science.

IV. Place of Course in College Curriculum

A. Free Elective
B. This course meets a program requirement for the Associate of Applied Science degree program in Medical Laboratory Technology
C. To see course transferability: a) for New Jersey schools, go to the NJ Transfer website, www.njtransfer.org; b) for all other colleges and universities, go to the individual websites.

V. Outline of Course Content

I. GENERAL CHEMISTRY
- A. Carbohydrates
  - 1. Biochemical theory and physiology
    - a. Metabolic pathways
    - b. Normal and abnormal states
    - c. Physical and chemical properties
  - 2. Test procedures
    - a. Principles
    - b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
    - c. Tolerance testing
    - d. Glycated proteins
  - 3. Test result interpretation
  - 4. Disease state correlation
- B. Lipids
  - 1. Biochemical theory and physiology
    - a. Metabolic pathways
    - b. Normal and abnormal states

c. Physical and chemical properties
1) Lipoproteins
2) Phospholipids
3) Triglycerides
4) Cholesterol
5) Apolipoproteins

2. Test procedures
a. Principles
b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances

3. Test result interpretation
4. Disease state correlation

C. Heme Derivatives
1. Biochemical theory and physiology
a. Metabolic pathways
b. Normal and abnormal states
c. Physical and chemical properties
1) Hemoglobin
2) Bilirubin
3) Urobilinogen
4) Myoglobin

2. Test procedures
a. Principles
b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances

3. Test result interpretation
4. Disease state correlation

II. PROTEINS AND ENZYMES
A. Enzymes
1. Biochemical theory and physiology
a. Metabolic pathways
b. Normal and abnormal states
c. Physical and chemical properties
1) LD
2) CK
3) AST/ALT
4) GGT
5) Lipase
6) Amylase
7) Alkaline phosphatase
8) Other enzymes

2. Test procedures
a. Principles
b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances

3. Test result interpretation

4. Disease state correlation

B. Proteins and Other Nitrogen-Containing Compounds

1. Biochemical theory and physiology

a. Metabolic pathways

b. Normal and abnormal states

c. Physical and chemical properties

1) Proteins

2) Amino acids

3) Urea

4) Uric acid

5) Creatinine

6) Ammonia

7) Tumor markers

8) Viral proteins

9) Cardiac markers

10) Other compounds

2. Test procedures

a. Principles

b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances

c. Clearances

3. Test result interpretation

4. Disease state correlation

III. ACID-BASE, BLOOD GASES AND ELECTROLYTES

A. Acid-Base Determinations (Including Blood Gases)

1. Biochemical theory and physiology

a. Henderson-Hasselbach equation

b. pH and H+ ion concentration

c. CO2 and O2 transport

d. Normal and abnormal states

2. Test procedures

a. Analytical principles

b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances

3. Test result interpretation

4. Disease state correlation

B. Electrolytes

1. Biochemical theory and physiology

a. Sodium, potassium, chloride, CO2, bicarbonate

b. Calcium, magnesium, phosphorus, iron, TIBC

c. Trace elements

d. Normal and abnormal states

2. Test procedures

a. Principles

b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances

3. Calculations (osmolality, anion gap)
4. Test result interpretation
5. Disease state correlation

IV. SPECIAL CHEMISTRY

A. Endocrinology

1. Biochemical theory and physiology
    a. Metabolic pathways
    b. Normal and abnormal states
    c. Mechanism of action
    d. Physical and chemical properties
        1) Steroid hormones (e.g., cortisol, estrogen, hCG)
        2) Peptide hormones (e.g., insulin, prolactin)
        3) Thyroid hormones
        4) Other hormones
2. Test procedures
    a. Principles
        1) Fluorescence
        2) Immunoassay
        3) Other methods
    b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
    c. Stimulation/suppression tests
3. Test result interpretation
4. Disease state correlation

B. Vitamins and Nutrition

1. Biochemical theory and physiology
    a. Metabolism and action
    b. Normal and abnormal states
    c. Properties
        1) Vitamin D
        2) Vitamin B12/folate
        3) Other vitamins
2. Test procedures
    a. Principles
    b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
3. Test result interpretation
4. Disease state correlation

C. Therapeutic Drug Monitoring

1. Pharmacokinetics
    a. Therapeutic states
    b. Toxic states
    c. Metabolism and excretion
2. Chemical and physical properties
    a. Aminoglycosides (e.g., gentamicin)
    b. Cardioactive (e.g., digoxin)

c. Anti-convulsants (e.g., phenobarbital)
d. Anti-depressants (e.g., lithium)
e. Immunosuppressants (e.g., tacrolimus)
f. Other drugs

3. Test procedures
   a. Principles
      1) Immunoassay
      2) Other methods
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
4. Test result interpretation
5. Disease state correlation

D. Toxicology
1. Toxicokinetics
   a. Toxic effects, signs and symptoms
   b. Metabolism and excretion
2. Chemical and physical properties
   a. Alcohols
   b. Heavy metals (e.g., lead)
   c. Analgesics (e.g., acetaminophen)
   d. Drugs of abuse
   e. Other toxins
3. Test procedures
   a. Principles
      1) Immunoassay
      2) Other methods
   b. Special precautions, specimen collection and processing, troubleshooting, and interfering substances
4. Test result interpretation
5. Disease state correlation

VI. General Education and Course Learning Outcomes

A. General Education Learning Outcomes:

At the completion of the course, students will be able to:

1. Explain the principles and significance of clinical chemistry tests and results (NJ GE-1).
2. Use appropriate mathematical applications to interpret data (NJ GE-2*).
3. Explain the principles of and demonstrate correct use of clinical chemistry instrumentation and technology (NJ GE-1, 3, 4).

(*Embedded critical thinking)

B. Course Learning Outcomes:

At the completion of the course, students will be able to:

1. Describe pre- and post-examination procedures of clinical chemistry.
2. Perform clinical chemistry assays according to standard operating procedures.
3. Troubleshoot clinical chemistry assays.
4. Explain the purpose of quality assurance.

C. Assessment Instruments

1. Exams
2. Assignments
3. Quizzes
4. laboratory products
5. laboratory reports
6. research papers
7. demonstrations
8. essays
9. journals
10. portfolios

VII. Grade Determinants

A. Exams
B. Assignments
C. Quizzes
D. laboratory reports
E. research papers

The primary formats, modes, and methods for teaching and learning that may be used in the course:

A. lecture/discussion
B. small-group work
C. computer-assisted instruction
D. guest speakers
E. laboratory
F. student oral presentations
G. simulation/role playing
H. student collaboration
I. independent study

VIII. Texts and Materials

A. Textbooks

Sample of specific text which may be featured:

- Clinical Laboratory Chemistry, 2nd edition. Sunheimer & Graves, Pearson.

(Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.)

IX. Resources

A. Laboratory
B. Computers with internet access.
C. RVCC library databases.

X. Honors Options

An Honors Option is not available for this course.