COURSE OUTLINE

Course Number: MLT 200
Course Title: Clinical Chemistry
Credits: 4

On-campus and Hybrid

Hours:
Lecture 3 / Lab 2

Pre-requisite:
Permission of Program Coordinator

Spring 7A

Catalog description: Clinical chemistry principles and its application through analysis of clinical specimens. This class is an in-depth study of the chemistry related to the physiological and pathophysiological processes in the human body. Emphasis is placed on methodologies that monitor body electrolyte, acid and base balance; renal, hepatic, cardiac functions; carbohydrate, heme, protein, enzyme, and lipid metabolism. Brief sections on measurements of endocrine functions, molecular diagnostics, therapeutic drug monitoring, toxicology, tumor markers, vitamins, mineral metabolism, as well as geriatric and pediatric testing. This class is a comprehensive study of specimen processing, analysis, test interpretation and quality control procedures used in routine manual and automated clinical chemistry testing. Students will present a group presentation of an assigned chemistry analyzer that focuses on the instrument’s principles of operation, components, maintenance, and means of quality control.

Revision Date: 1/2020

Course Coordinator: Lisa M Shave M.S., MLS(ASCP)CM SBB CM
Course Instructor: Office hours: In-person
Zoom virtual meeting: Any day/time by appt. only
Phone:
Email:

Course Materials
Required
2. White lab coat- This must be a knee-length coat with a fitted wristband/cuff; it reduces the potential for splashes up the arm and fire hazards.
3. Gloves - latex or nitrile, not vinyl
4. Pocket calculator
5. Digital timer that indicates time in minutes and seconds.
6. Black or blue ink pen. (NO WORK IN PENCIL ACCEPTED)
7. Sharpie or other permanent marker, fine point, black or blue
8. Notebook/3 ring binder:
   - Tabs or dividers are needed to identify and separate the following sections: Syllabus - including schedule and unit objectives, lecture PowerPoints, graded materials & other informative material.
9. Laboratory manual:
Print laboratory exercises BEFORE class. Save all procedures, pre-labs, in-lab exercises, case studies and study questions.

**Course Format/Delivery**

**On-campus**- This is a face-to-face course whereby students meet two days a week. Didactic course material is presented on-campus with lecture-based instruction in the morning followed by student laboratory sessions in the afternoon. The course requires a lot of outside proactive work by the student. The instructor will provide guidance as needed. Students will access and print out course materials from the course’s Blackboard shell. Assessment activities are provided as a means of assisting students in determining their level of competence in given areas as well as to assist in reviewing for examinations. Weekly homework assignments will be required to enhance the student’s learning experience.

**Hybrid**- This is a web-blended course whereby didactic course material is presented mainly online and student laboratory sessions are held weekly on the college campus. The course requires a lot of outside proactive work by the student. The instructor will provide guidance as needed. Students will access and print out course materials from the course’s Blackboard shell. Lab manuals are available for purchase the MCCC bookstore. Assessment activities are provided as a means of assisting students in determining their level of competence in given areas as well as to assist in reviewing for examinations. Assignments will be posted to enhance the student’s learning experience. Online discussion boards are mandatory; they are an essential tool for communication between peers and between students and instructors. The student must take all major examinations (midterm and final) at an approved testing center.

**Technology Expectations**

Students must have access to a computer with Internet connection, either at home, the library or MCCC campus. A 56K modem connection is recommended. Mozilla Firefox 3.6 browser is recommended, although Internet Explorer 7 and 8, Google Chrome and Safari 4.3.2 can be used. AOL is NOT supported by Blackboard. Cookies, JavaScript, Active Scripting and Pop-up Windows must be enabled on the browser you use.

**Schedule**

**Lecture Meeting Days** = There are scheduled face-to-face classes.

**Lecture Modes of Instruction**

- Blackboard Learning Management System (see below for access directions)
- Lecture PowerPoints
- Internet resources
  - MediaLab, Inc (click for link)
  - Kahoot
  - Others (Youtube, etc.)

**Laboratory Room/Time** = MS320 on Tuesdays and Thursdays (OC) and Wednesdays (Hybrid). Face-to-face laboratory sessions will take place in the afternoon on meeting days in Room MS320, during the semester and will be mandatory. All laboratory procedures MUST be PRINTED for each laboratory session. Students must abide by all policies contained in the college and program handbook & Lab Safety Manual.

**Time Commitment**

According to Flint’s “Surviving College,” (https://www.umflint.edu/advising/surviving_college.htm) you should budget your time per week for this four hour credit course as follows:

1. PowerPoints/Readings assigned: 3 to 6 hours
2. Assignments: 3 to 6 hours
3. Time for review and test preparation: 3 hours
4. Total study time per week 9 to 12 hours PER WEEK

**MCCC General Education Core Competencies and Goals**

**Institutional Learning Goals (ILG)**

**Goal 1.** Written and Oral Communication in English: Students will communicate effectively in both speech and writing.
Goal 2. Mathematics: Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Goal 3. Science: Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Goal 4. Technology or Information Literacy: Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Goal 5. Social Science: Students will use social science theories and concepts to analyze human behavior and social and political institutions and to act as responsible citizens.

Goal 6. Humanities: Students will analyze works in the fields of art, music, or theater; literature; philosophy and/or religious studies; and/or will gain competence in the use of a foreign language.

Goal 7. History: Students will understand historical events and movements in World, Western, non-Western or American societies and assess their subsequent significance.

Goal 8. Diversity and Global Perspective: Students will understand the importance of a global perspective and culturally diverse peoples.

Goal 9. Ethical Reasoning and Action: Students will understand ethical frameworks, issues and situations.

Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate and effectively use information for college level work.

Goal 11. Critical Thinking: Students will use critical thinking skills, understand, analyze, or apply information or solve problems.

Course Competencies/Goals:

Upon completing the course, the student will be able to:

1. Identify key elements of laboratory safety and universal precautions.
2. Demonstrate knowledge of the function and physiology of the body systems including renal, liver, cardiovascular, respiratory, digestive, endocrine, and reproductive.
3. Correlate clinical chemistry laboratory results to conditions of health or disease in the human body.
4. Apply knowledge of general and physiological chemistry to manual and automated laboratory testing.
5. Apply knowledge of mathematics in the performance and analysis of statistical measurements used for quality assessment in the clinical laboratory.
6. Discuss topics in relation to tumor markers, therapeutic drug monitoring and toxicology.
7. Recognize differences in reference ranges for diverse populations.
8. Demonstrate critical thinking skills in the evaluation of patient case studies relating data to a medical diagnosis and clinical conditions that occur as a result of disease processes.
9. Access information on a chemistry analyzer and prepare a classroom presentation.

Units of Study in Detail

Week 1: Basic Laboratory Safety, Laboratory Instrumentation and Test Methodologies and Informatics At the end of this week, students will be able to:

Learning (cognitive) objectives:
1. Identify methods used to produce laboratory grade water for use in the clinical laboratory. ILG 3
2. List 3 parameters that need to be monitored during the purification process. ILG 1, 3
3. Explain the purpose of different types of glassware used in clinical chemistry. ILG 3, 11
4. Identify different types of plasticware used in chemical laboratory. ILG 3
5. Explain the proper use of pipettes when working with laboratory reagents and clinical specimens. ILG 2, 3, 4, 11
6. Provide the correct words that correspond to the following abbreviations: OSHA, SDS, NFPA, HEPA, RACE, PASS, and CFR. ILG 1, 10, 11
7. Describe the role of regulatory agencies in maintaining standards in laboratory testing. ILG 1, 5, 10
8. List several responsibilities of employers and employees in maintaining a safe work environment. ILG 1, 5
9. Explain how the measurement of light can be used to measure analytes in a solution. ILG 1, 2, 3, 4, 11
10. Describe the technology used in the following analytical methods: Spectrophotometry, Reflectometry, Chemiluminescence, Fluorometry, Nephelometry, Refractometry, Electrochemistry, Electrophoresis and Chromatography ILG 1, 3, 4, 11

11. Identify terms associated with automated testing such as throughput, test menu, carryover, discrete testing, random access, open-reagent analyzer, closed-reagent analyzer, and LIS. ILG 1, 4

12. Describe the advantages and disadvantages of automated laboratory testing. ILG 1, 4, 11

13. Explain the preanalytical, analytical and post analytical stages of laboratory testing. ILG 1, 10, 11
   - Identify five laboratory tasks associated with the preanalytical stages of lab testing.
   - List four tasks associated with the analytical stage of laboratory testing
   - Identify three tasks associated with the postanalytical phase of testing.

14. State the two items required to interface computers. ILG 1, 4

15. State two ways of entering laboratory data into a computer. ILG 1, 4

16. Review the principles behind immunoassays. ILG 3

17. Recall the different techniques used in DNA analysis during molecular testing. ILG 3

Performance (psychomotor) objectives:
1. Demonstrate proper use of various pipettes in the clinical lab. ILG 3
2. Perform simple and serial dilutions. ILG 2, 3, 4
3. Experiment with the functions of a spectrophotometer. ILG 3, 4
4. Calculate the concentration of a solution given the absorbent values for test and standard samples. ILG 2

Affective Objectives: By the end of this unit, the student should be able to demonstrate the following behaviors and attitudes:
1. Perform analysis carefully with proper technique while paying close attention to detail and quality.
2. Maintain and operate equipment and instrumentation reliably to generate quality results.
3. Leaving work area, equipment and instrumentation in clean and in good working order after use.
4. Organize for priority and efficiency.

Week 2: Laboratory Mathematics, Statistics, Method development and Quality Control At the end of this week, students will be able to:

Learning (cognitive) objectives:
1. Define the different measures for solution concentration including specific gravity, molarity, normality, molality and percent solution. ILG 1, 2, 3
2. Convert results from one unit to another. ILG 2
3. Convert temperatures from one system to another. ILG 2
4. Calculate the volume of diluent needed to make up various dilutions. ILG 2
5. Explain how a serial dilution is performed. ILG 1, 2, 11
6. Explain how a Gaussian curve is used in laboratory quality assurance. ILG 1, 2, 3, 10 11
7. Differentiate the terms: precision, accuracy, sensitivity and specificity. ILG 1, 11
8. Explain how a Levy-Jennings chart and Westgard Rules are used for quality control. ILG 1, 2, 3, 11

Performance (psychomotor) objectives:
1. Calculate the following: coefficient of variation, mean, median, standard deviation. ILG 2
2. Use statistical analyses to construct a Levey-Jennings chart. ILG 2, 11
3. Interpret Levey Jennings charts as it relates to Westgard rules. ILG 1, 2, 10 11
   • Determine the ranges and investigate for random errors, shifts and trends.
4. Compute solutions and their concentrations using laboratory mathematical equations. ILG 2, 3, 4

Week 3: Carbohydrates, Lipids, Lipoproteins, Amino Acids, Proteins, and Enzymes At the end of this week, students will be able to:
Learning (cognitive) objectives:
1. Discuss the molecular structure and function of carbohydrates. ILG 3, 11
2. Summarize the biochemical pathways of carbohydrate metabolism. ILG 1, 3, 11
3. List the endocrine glands and hormones that affect carbohydrate metabolism. ILG 1, 3, 11
4. Compare and contrast Type-1 and Type-2 diabetes. ILG 3, 11
5. Explain the physiological changes that occur with hyper- and hypoglycemia. ILG 1, 3
6. Describe the methodologies used to measure serum, urine and body fluid glucose levels. ILG 1, 3
7. Identify abnormal and critical levels of glucose. ILG 1, 3, 11
8. Distinguish between cholesterol, lipids, triglycerides and fatty acids. ILG 3
9. Explain the role of apolipoproteins. ILG 1, 3
10. Identify the risk factors associated with coronary heart disease ILG 3
11. Explain the laboratory methodologies for measuring serum/plasma lipids. ILG 1, 3
12. Describe the structure and function of proteins. ILG 1, 3, 11
13. Explain the significance of the protein bands seen in serum protein electrophoresis. ILG 1, 3, 4
14. Discuss causes of hyper- and hypoproteinemia. ILG 1, 3, 10
15. Compare the methodologies used for measuring protein and albumin in clinical specimens. ILG 3
16. Describe the methods used for protein screening in urine and the clinical significance of a positive test. ILG 1, 3, 10, 11
17. Explain the clinical significance of an elevated protein level in CSF and the methodologies used for measurement. ILG 1, 3, 10, 11
18. Define and calculate an A/G ratio. ILG 1, 2
19. Explain the function of enzymes. ILG 1, 3
20. Describe enzymatic reactions including first and zero-order kinetics, cofactors and factors that affect reaction speed. ILG 1, 2, 3
21. Summarize the clinical significance of the following enzymes: CK, LD, AST, ALT, ALP, GGT, 5'-NT, Amylase, Lipase and Trypsin. ILG 1, 10
22. Describe the methodologies used for measuring serum enzymes. ILG 1, 3

Performance (psychomotor) objectives:
1. Distinguish between the two types of diabetes using simulated urinalysis and ELISA tests. ILG 11
2. Practice micropipetting using a testing kit that measures accuracy and precision. ILG 4
3. Perform a protein electrophoresis. ILG 3, 4

Affective objectives:
1. Strictly follow written procedures and verbal instructions.
2. Demonstrate initiative and resourcefulness; learn more than the minimum.
3. Demonstrate consideration for other students in the student laboratory and a spirit of teamwork.

Week 4: Non-Protein Nitrogen, Renal Functions and Electrolyte Homeostasis At the end of this week, students will be able to:

Learning (cognitive) objectives:
1. Describe the anatomy and physiology of the kidney. ILG 1, 3, 10
2. Explain the source of blood urea nitrogen and creatinine and the role they play in the assessment of kidney function. ILG 1, 3, 10, 11
3. Define ‘azotemia’ and describe common causes of this condition. ILG 1, 3
4. Summarize the formation and excretion of uric acid. ILG 1, 3
5. Explain the condition of ‘gout’: its causes and treatments. ILG 1, 3
6. Describe how a ‘creatinine clearance’ is performed. ILG 1, 3, 10, 11
7. List other screening tests for renal disease. ILG 1
8. Explain how dialysis helps in the treatment of renal disease. ILG 1, 3, 10, 11
9. List the significant electrolytes routinely measured in the laboratory. ILG 1, 3, 10
10. Define and calculate an ‘anion gap’. ILG 1, 2
11. Explain the clinical significance of serum and urine osmolality. ILG 1, 3
12. Name the colligative properties of solutions used in measuring osmolality. ILG 1, 3

Performance (psychomotor) objectives:
1. Participate in a demonstration of a variety of osmometers with the help of an Allied Instruments® representative. ILG 1, 3, 4

Week 5: Blood Gases and Acid-Base Balance, Mineral and Bone Metabolism and Body Systems’ Functions
(Endocrine System, Pancreas; Gastrointestinal, Cardiac) At the end of this week, students will be able to:

Learning (cognitive) objectives:
1. State the Henderson–Hasselbalch equation and identify the respiratory and metabolic components. ILG 1, 2, 3, 11
2. Define respiratory and metabolic alkalosis and acidosis. ILG 1, 3, 10
3. Calculate various blood gas parameters given the appropriate equation(s) ILG 2
4. Explain the role of the lungs, kidneys and physiological buffer system in acid-base balance. ILG 1, 3
5. Identify the five ways in which carbon dioxide is carried in blood. ILG 1, 3, 10
6. Identify appropriate calibration materials to use for pH, PCO2, and PO2 measurements. ILG 1, 2, 4
7. Describe the proper control material to use for blood pH, PCO2, and PO2 measurements. ILG 1, 4
8. Identify preanalytical sources of errors in blood-gas analysis. ILG 1, 10
9. Describe the collection method, testing methodologies and result parameters seen in blood gas analysis. ILG 1, 4
10. Identify three forms of calcium as they exist in circulation. ILG 1, 3
11. Describe laboratory methods used for measuring serum calcium and phosphate. ILG 1, 3
12. Discuss the clinical significance of measuring ionized magnesium. ILG 10
13. Identify biochemical markers specific for bone formation and resorption. ILG 1, 3, 10
14. List the function of the following hormones: thyroxine, cortisol, epinephrine, antidiuretic hormone, growth hormone, aldosterone, luteinizing hormone, FSH, estrogen, progesterone, testosterone, prolactin, oxytocin. ILG 1, 3, 10
15. Discuss methodologies used to measure hormones in the laboratory. ILG 1, 10
16. Define the ‘negative feedback system’ as it relates to hormone regulation. ILG 1, 3, 10, 11
17. Outline the functions of the components of the GI system. ILG 1, 10
18. Explain laboratory tests used to assess diseases of the GI tract. ILG 1, 10
19. Summarize the endocrine and exocrine function of the pancreas. ILG 1, 11
20. Outline the functions of the components of the GI system. ILG 1, 10
21. List laboratory tests used to assess hepatic function. ILG 1, 10
22. Explain the role that PTH and Vitamin D has on calcium and phosphate levels. ILG 1, 3, 10
23. Explain the following laboratory tests used to assess cardiac function: Myoglobin, CK-MB, Troponin and BNP. ILG 1, 3, 10

Performance (psychomotor) objectives:
1. Challenge the procedure for a ‘creatinine clearance’ test and by performing calculations through examples. ILG 1, 2, 3, 11
2. Apply knowledge gained from the previous few weeks into solving clinical chemistry case studies. ILG 1, 11

Week 6: Liver Function, Porphyrins and Hemoglobin, and Therapeutic Drug Monitoring and Toxic Substances
At the end of this unit, students will be able to:

Learning (cognitive) objectives:
1. Describe the structure and function of the liver. ILG 1, 3
2. Summarize the breakdown of bilirubin. ILG 1, 3
3. State the differences between conjugated, unconjugated, direct, indirect and total bilirubin. ILG 1, 3, 10
4. Describe the pathology of the following liver disorders: Jaundice, Hepatitis, Cirrhosis, Bile duct obstruction, inherited metabolic disorders and enzyme deficiencies. ILG 1, 3, 10
5. Explain the clinical significance of an elevated serum ammonia level. ILG 1, 3, 11
6. List the laboratory tests that are included in liver function assessment. ILG 1, 10
7. Describe the physiology, transport and metabolism of iron. ILG 1, 3, 10
8. Identify laboratory methods used to measure serum iron, porphyrins and hemoglobin. ILG 1, 10
9. Define the term ‘pharmacokinetics’ and its implication in TDM. ILG 1, 10
10. Identify the four principle biological events associated with pharmacokinetics. ILG 1, 10
11. Explain the terms: elimination half-life, steady state, bioavailability, loading dose, peak & trough. ILG 1, 3, 10
12. List therapeutic drugs that are commonly measured in the laboratory. ILG 1, 10
13. List several examples of toxic substances measured in clinical laboratories. ILG 1, 3, 10
14. Identify laboratory methods used to measure selected toxic substances. ILG 1, 3, 10
15. List six substances that are frequently used as adulterants in urine specimens for drug abuse testing. ILG 1, 3, 10
16. Describe laboratory methods used for screening for drugs of abuse. ILG 1, 3, 4
17. Identify the acidic or ketone metabolites of: ethanol, methanol, ethylene glycol, isopropyl alcohol, and salicylate. ILG 1, 3, 10
18. List causes of high blood levels of lead. ILG 1, 3, 10
19. Discuss the physiological role of trace elements in the body. ILG 1, 3, 11
20. Identify specimen types and instrumentation used to measure trace elements in the laboratory. ILG 1, 4, 10

Performance (psychomotor) objectives
1. Experiment with thin layer chromatography to separate and analyze a variety of molecular mixtures. ILG 3, 4, 11
2. Analyze patient samples for the presence or absence of drugs of abuse. ILG 3, 4

Week 7: Nutrition, Vitamins, Tumor Markers, Geriatric and Pediatrics
At the end of this unit, students will be able to:

Learning (cognitive) objectives:
1. Differentiate between fat and water soluble vitamins. ILG 3
2. Identify laboratory methods for measuring vitamin levels. ILG 1, 3
3. Correlate abnormal levels of vitamins with various disease states. ILG 3, 10
4. List the tumor markers that are used in assessing cancer. ILG 1, 3, 10
5. Explain the methodologies used in detecting tumor markers. ILG 1, 3, 10
   • Prostate disease
   • Ovarian cancer
   • Breast cancer
   • Bladder cancer
   • Pancreatic cancer
6. Discuss briefly the changing demographics of the geriatric population ILG 1, 3, 10
7. Describe briefly the physiological changes with aging. ILG 1, 3, 10
8. Distinguish infant, child, and adolescent stages of life. ILG 1, 10
9. List five factors that should be considered when using peer review of pediatric reference intervals. ILG 1, 10
10. Summarize the changes that occur in infants, children, and adolescents regarding disorders of respiratory, liver, kidney, thyroid, calcium, diabetes mellitus, inborn errors of metabolism, and nutrition. ILG 1, 3, 10, 11
11. Identify specimen requirements and specimen integrity issues of selected laboratory tests. ILG 3

Performance (psychomotor) objectives:
1. Experimenting with levels of hCG via an ELISA test. ILG 4, 11
2. Diagnostically measuring levels of drugs of abuse using a manufactured rapid immunoassay kit. ILG 4, 11

Affective Objectives
Affective objectives are behavioral standards that will be implemented during the professional phase of the Medical Laboratory Technology Program. Students’ professional performances will be evaluated during the laboratory course and will be returned
to the student with their all laboratory worksheets submitted. This has a direct effect on the final letter grade earned. See below for a detailed list of the criteria. Unsatisfactory performance in any area of the behavioral standards will require a consultation with the faculty and/or the MLT Program coordinator. The reason for the consultation will be clearly stated, counsel will be given and an action plan will be implemented. The student will be given the opportunity to give a written response. The consultation form will be kept in the student’s file.

**PROFESSIONAL PERFORMANCE EVALUATION**

1. **DEPENDABILITY**
   The student arrives in the laboratory with adequate time to start lab session as scheduled. The student comes with appropriate manual and supplies, and wearing required laboratory attire. The student shows evidence of having reviewed the assigned topic before coming to the laboratory. The student completes assignments (lab reports, homework assignments, etc) on time.

2. **ATTENTIVENESS**
   The student is attentive to the instructor, takes complete notes and proceeds with laboratory work without repeated instructions. The student follows verbal and written instructions, asks pertinent questions when necessary, and seeks the instructor’s assistance when needed. The student neither distracts others nor allows distractions to affect completion of laboratory exercises.

3. **ORGANIZATION**
   The student demonstrates the ability to organize work to be done within the available laboratory time. The student is able to perform multiple tasks without jeopardizing accuracy and precision.

4. **INDEPENDENCE**
   The student demonstrates the ability to work independently by exercising independent judgement and thinking logically in using the protocols and instructions given. The student draws on previously gained information to solve problems without prompting from instructor. The student seeks activities to expand knowledge, ability and performance.

5. **RECORD KEEPING**
   The student demonstrates the importance of proper record keeping by accurately and legibly labeling/recording laboratory work and reports (i.e. sample containers, reagents and worksheets).

6. **MANAGEMENT AND ECONOMY**
   The student conserves reagents and supplies. The student maintains an adequate supply of common use items at their appropriate workstation. The student takes proper care of equipment.

7. **SAFETY**
   The student works in an orderly and safe manner, enabling others to safely work in the same general area. The student adheres to the guidelines of the Laboratory Safety Regulations (e.g. wearing eye protection, keeping long hair tied back, and properly storing hazardous materials).

8. **INTERPERSONAL SKILLS**
   The student communicates in a professional, positive, tactful manner with peers and instructors. The student consistently shows common courtesy (e.g. restocks supplies) and contributes towards achieving an environment conducive to work and learning for self and others.

9. **COMPOSURE**
   The student maintains composure and work quality under stressful conditions and adapts quickly to new situations. The student recognizes his/her own personal strengths and weaknesses and works positively within that framework. The student accepts evaluation of performance as constructive when offered by instructors and follows through with suggestions made.

10. **INTEGRITY**
    The student accepts accountability for work performed. The student readily admits errors, follows procedures (including quality control) as written, and maintains confidentiality of patient results, if applicable. Student exhibits perseverance to obtain accurate results.

*Scoring*: Total number of possible points = # of weeks x # of categories x 4 (Greatest achievable score) = Achieved points = student scores: Total of numbers each week (#4s + #3s + #2s + #1s)

*Cut off values:*
- Upper cut-off value = 0.675n
- Lower cut-off value = 0.425n

**How your final grade can be Affected**

- If a > 0.675n, then the course grade is increased one step (e.g., from C to C+).
- If a is between 0.425n and 0.675n, then the course grade is unaffected (e.g., C remains C).
- If a < 0.425n, then the course grade is decreased one step (e.g. C to C-).
- If course grade remains within range: student will receive full credit for affective score.
**Grading:**
To receive a passing grade, students must earn a 77 or higher. A final grade of 77 or higher is required in each Medical Laboratory Technology course in order to progress to the next MLT course and to graduate. No make-up exams are to be given unless there are extenuating circumstances.

**Lecture:**
- Homework ........................................ 10%
- Quizzes (4) ..................................... 15%
- Midterm .......................................... 15%
- Final ........................................ 20%

**Total Lecture 60%**

**Lab:**
- Assignments
  - Homework/Quizzes .................. 10%
  - Midterm ................................. 10%
  - Lab Final .................................. 10%
  - Analyzer Presentation .......... 10%

**Total Lab 40%**

**Grading Scale:**

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<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100</td>
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<td>A-</td>
<td>90-92</td>
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<td>B+</td>
<td>87-89</td>
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**Extra credit** work will not generally be recognized in evaluating student performance; however, individual instructors have limited flexibility in recognizing additional effort by an individual student. For this course, there is NO EXTRA CREDIT opportunities.

**Late work**
- 5 points will be deducted for each day the assignment is late, up to 5 days. Assignments submitted 6 or more days late will be graded and returned to the student, but the grade awarded will be “0”.
- **THERE ARE NO MAKEUP EXAMS** (including online and in-person). Except in extreme cases of sickness (contagion or hospitalization, etc.) or death of an immediate family member (father, mother, grandparent, sibling, spouse, or child). Students must provide supporting documentation before the make-up will be administered. It is the responsibility of the student to contact the instructor for make-up exams and to provide the documentation.

**Progression in the MLT Professional Courses**
As noted in the MLT Program handbook, a final grade of a C+ or better in each Medical Laboratory Technology course is necessary to progress to the next professional phase course.

**Unsatisfactory Performance**
Unsatisfactory performance in any area (cognitive, psychomotor or affective), failure to follow directions or procedures, unsafe or unethical behavior, or failure to keep a grade of 77 or above in the course will require a consultation with the faculty and/or the MLT Program coordinator. The reason for the consultation will be clearly stated, counsel will be given and an action plan will be implemented. The student will be given the opportunity to give a written response. The consultation form will be kept in the student’s file and progress must be made by following the plan of action.

**Discussions**
Although not explicitly graded, you will be evaluated on the QUALITY of your contributions and insights. Quality comments possess one or more of the following properties:
- Offers a different and unique, but relevant, perspective;
- Contributes to moving the discussion and analysis forward;
- Builds on other comments;
- Transcends the “I feel” syndrome. That is, it includes some evidence, argumentation, or recognition of inherent tradeoffs. In other words, the comment demonstrates some reflective thinking;
- Follow proper online discussion etiquette: [Online Discussion Etiquette Guide](#)
Discussion Rubric
You must post an initial thread in response to the Discussion topic and comment on at least 2 other students to receive full credit. See below for the rubric image. The most amount of points awarded for each discussion is 3 points. 3 pts=100%

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Note: Please use the following FORMAT as the SUBJECT LINE FOR YOUR INITIAL DISCUSSION which must be posted by WEDNESDAY of each week. “LASTNAME.WEEK_DISCUSSION”

Example= SHAVE.WEEK 1 DISCUSSION
SHAVE.WEEK 2 DISCUSSION

Thank you for your cooperation. Failure to comply with this may limit the Professor’s ability to grade you fairly.

Communication between Student and Instructor
Instructor role:
- **Blackboard Announcements** will be posted by the instructor in the Announcement Page of the course. This announcement will forever appear on this page. A copy of the message is also sent to your MercerMail.
- **Email Communication**: As previously mentioned, all communication will be sent to your MercerMail account.

Student role:
- **Students are expected to check their Mercermail at least once daily M-F and once during the weekend for important course related messages (announcements and emails from the instructor).**
- **Blackboard Announcements**: students should be sure to check their email as well as the Blackboard section each time they sign on to the course.
- **Immediate, specific, personal questions for the instructor**: Students can send a message through Blackboard using the Course Messages link on the tab to the left in the course or write an email using your MercerMail.

Turnaround Time (Instructor to Student)
- **Questions (Non-assignments)**: You can expect all correspondence sent via email using your MercerMail to your instructor to be responded to within 24 hours Monday through Friday. The instructor will notify the class if there will be longer periods of time where responses may be delayed.
• **Assignments/Exams/Grades**
  Turnaround times for papers, journals, essays, short-answer questions and other manually graded written assignments will be graded within one week after the due date. Grades will be posted to BlackBoard LMS.

**Attendance**
Attendance and participation at all classes is consistent with academic success. In addition, today’s health care employer puts great emphasis on attendance and often times request to see a referral from this program concerning your attendance record.

• **Face-to-Face Lecture Policy**
  - Students are expected to attend all lecture sessions. If an extenuating absence is anticipated, please e-mail shavel@mccc.edu or call/leave a message at my office 609-570-3387. **Please leave a message if your call forwards to voicemail.** Absence from class, even if called in, must be for a legitimate reason; otherwise the absence will be counted as unexcused. The student is responsible for any material missed. For any missed labs, the student will receive a zero as a participation and any assignments that were due that or handed out on that day.

  • **Excessive absence:** If a student misses more than 10% of the meeting days, they must report to a mandatory consultation with the Instructor to develop a corrective action plan.
      - A student must follow this plan. If the student continues to miss more than 20% of a course’s meeting days or does not follow the action plan, the student will be dismissed from the course with a W or receive a grade of F if the course is past the college’s withdrawal period.

  • **Lateness/Exits:** Students are allowed two (2) unexcused lateness’s or exits from class. Each additional lateness or exit will result in a half a letter grade deduction. Lateness is defined as appearing for class 10 minutes or more after the start of the scheduled Session. Exit is defined as leaving a class for 10 minutes or more while it is in progress and returning, or leaving early from a class that is in progress.

• **Face-to-Face Laboratory:** **Students MUST attend all Weekly Laboratory classes.** There are NO makeups.

  • **Excessive absence:** If a student misses more than 10% of the meeting days, they must report to a mandatory consultation with the Instructor to develop a corrective action plan.
      - A student must follow this plan. If the student continues to miss more than 20% of a course’s meeting days or does not follow the action plan, the student will be dismissed from the course with a W or receive a grade of F if the course is past the college’s withdrawal period.

  • **Lateness/Exits:** Students are allowed two (2) unexcused lateness’s or exits from class. Each additional lateness or exit will result in a half a letter grade deduction. Lateness is defined as appearing for class 10 minutes or more after the start of the scheduled Session. Exit is defined as leaving a class for 10 minutes or more while it is in progress and returning, or leaving early from a class that is in progress.

  • **Withdrawn Immediately**
      - If you miss a full week of laboratory sessions, you may be withdrawn from the course with a W or receive a grade of F if the course is past the college’s withdrawal period.

*The Department reserves the right to require written verification for absences. Students absent or late without notifying the Department are considered unexcused and are subject to the policies stated above.*

**Student complaints & Grade disputes:**
The student has a right to appeal the decision of the instructor or the Academic Integrity Committee. Judicial procedures governing violations of Academic Integrity are contained in the Student Handbook. Approved by the MCCC Board of Trustees March 18, 2004

**Academic Integrity Violations for On-Campus and Hybrid Students**
The college recognizes the following general categories of violations of academic integrity, with representative examples of each. Academic integrity is violated whenever a student:

...
A. Uses or obtains unauthorized assistance in any academic work.
   - copying from another student's exam
   - using notes, books, electronic devices or other aids of any kind during an exam when prohibited.
   - stealing an exam or possessing a stolen copy of an exam

B. Gives fraudulent assistance to another student.
   - completing a graded academic activity or taking an exam for someone else
   - giving answers to or sharing answers with another student before, during or after an exam or other graded academic activity.
   - sharing answers during an exam by using a system of signals

C. Knowingly represents the work of others as his/her own, or represents previously completed academic work as current.
   - submitting a paper or other academic work for credit which includes words, ideas, data or creative work of others without acknowledging the source.
   - using another author's words without enclosing them in quotation marks, without paraphrasing them or without citing the source appropriately.
   - presenting another individual's work as one's own.
   - submitting the same paper or academic assignment to another class without the permission of the instructor.

D. Fabricates data in support of an academic assignment.
   - falsifying bibliographic entries
   - submitting any academic assignment which contains falsified or fabricated data or results

E. Inappropriately or unethically uses technological means to gain academic advantage
   - inappropriately or unethically acquiring material via the Internet or by any other means.
   - using any electronic or hidden devices for communication during an exam.

Each instructor and Academic Student Resources area is authorized to establish specific guidelines consistent with this policy.

“Online students are held to the same level of accountability as students in a traditional classroom. As such, all online students should become familiar with and strictly adhere to MCCC’s Academic Integrity policies, which can be found at www.mccc.edu/academic_policies_integrity.

Furthermore, MercerOnline at Mercer County Community College provides each student with a unique username and password whereby students may access their online courses and complete work assigned therein. It is the responsibility of each student to keep these login credentials confidential. Sharing of login credentials with any individuals other than the course instructor or members of the MercerOnline staff is a grave violation of academic integrity policies and poses a risk to the security of their online course. Students who fail to maintain the confidentiality of their login credentials and thus compromise the security of the online course environment will be subject to disciplinary action.”

Consequences for Violations of Academic Integrity
For a single violation, the faculty member will determine the course of action to be followed. This may include assigning a lower grade on the assignment, assigning a lower final course grade, failing the student in the course, or other penalty appropriate to the violation. In all cases, the instructor shall notify the Chair of the Academic Integrity Committee of the violation and the penalty imposed. When two (or more) violations of academic integrity are reported on a student, the Academic Integrity Committee (AIC) may impose disciplinary penalties beyond those imposed by the course instructors. The student shall have the right to a hearing before the AIC or a designated AIC subcommittee.

MediaLab, Inc.
All students have a free subscription to MediaLab, Inc. which will be utilized for the purpose of enhancing concepts and skills learned each week. Students have already been granted access and should keep their username and password private. All assigned MediaLab courses must be completed by the deadline. A passing grade of 70% is required in order for the course to be deemed successful. Students may attempt a course twice. Please reach out to the instructor if you’d like to reattempt so that permission can be granted.

Cellular Telephones, Personal Telephone Calls, and Electronic Devices
Students are NOT to receive or place telephone calls or text messages during class, labs, or clinical hours. Cellular telephones and other electronic devices are to be silenced before entering the classroom, student laboratory, or the clinical site.
Inappropriate use of any electronic device may result in disciplinary action. Students wishing to take pictures or record a Professor’s instruction must be granted approval to do so.

**Reasonable Accommodations for Students with Documented Disabilities**
Mercer County Community College is in compliance with both the ADA and Section 504 of the Rehabilitation Act. If you have, or believe you have, a differing ability that is protected under the law please see Arlene Stinson in LB216, (609) 570-3525, stinsona@mccc.edu for information regarding support services. **These accommodations must be made PRIOR to the start of the course.**

**Equal Opportunity Policy**
Mercer County Community College is committed to equal opportunity and affirmative action. Discrimination on the basis of race, creed, color, national origin, ancestry, age, gender, affectional or sexual orientation, marital status, familial status, liability for service in the Armed Forces of the United States, nationality, political views, religion, disability unrelated to job or program requirements or any other characteristic protected by law is prohibited. Questions regarding the equal opportunity policy and compliance statement may be directed to the Affirmative Action Officer, West Windsor Campus, (609) 586-4800, ext. 3270
### MLT 200 Clinical Chemistry
#### On-campus SAMPLE Lecture Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Unit</th>
<th>1st Ed</th>
<th>2nd Ed</th>
<th>Quiz, HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>THU Jan 24</td>
<td>Laboratory Basics Safety in the Clinical Chemistry Lab.</td>
<td>1</td>
<td>2</td>
<td>HW 1 due (dropbox by 9am)</td>
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<td></td>
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</tr>
<tr>
<td>2</td>
<td>TUES Jan 29</td>
<td>Instrumentation, Laboratory Automation and Informatics</td>
<td>3</td>
<td>4</td>
<td>In-class Quiz 1 (on Week 1)</td>
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<tr>
<td></td>
<td>THU Jan 31</td>
<td>Laboratory Statistics, Method development and QC</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TUES Feb 5</td>
<td>Immunoassays, Molecular Diagnostics</td>
<td>5, 25</td>
<td>5, 6</td>
<td>HW 2 due (dropbox by 9am)</td>
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<tr>
<td></td>
<td>THU Feb 7</td>
<td>Carbohydrates, Lipids and Lipoproteins</td>
<td>6, 7</td>
<td>7,8</td>
<td>In-class Quiz 2 (on Week 2)</td>
</tr>
<tr>
<td>4</td>
<td>TUES Feb 12</td>
<td>Amino Acids, Proteins and Enzymes</td>
<td>8, 9</td>
<td>9,10</td>
<td>HW 3 due (dropbox by 9am)</td>
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<td></td>
<td>THU Feb 14</td>
<td>Non-protein nitrogen, Renal Function, Body water and Electrolyte Homeostasis</td>
<td>11, 12</td>
<td>11,12</td>
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</tr>
<tr>
<td>5</td>
<td>MIDTERM</td>
<td>MIDTERM (Weeks 1-4)</td>
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<tr>
<td></td>
<td>WEEK</td>
<td>TUES FEB 19-LEC – Case Study Day (Mandatory)</td>
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<td></td>
<td></td>
<td>THU FEB 21- LEC- LECTURE MIDTERM</td>
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<tr>
<td>6</td>
<td>TUE Feb 26</td>
<td>Blood gases, pH, Acid-Base Balance, Mineral and Bone Metabolism</td>
<td>13,14</td>
<td>13,14</td>
<td>HW 4 due (dropbox by 9am)</td>
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<tr>
<td></td>
<td>THU Feb 28</td>
<td>The Endocrine System, Gastrointestinal Function, Pancreas, and Cardiac Function</td>
<td>15,16,</td>
<td>15,16,</td>
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<td></td>
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<td>17,18</td>
<td>17,18</td>
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<tr>
<td>7</td>
<td>TUE Mar 5</td>
<td>Liver Function, Iron, Porphyrins, and Hemoglobin</td>
<td>19,20</td>
<td>19,20</td>
<td>HW 5 due (dropbox by 9am)</td>
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<tr>
<td></td>
<td>THU Mar 7</td>
<td>TDM and Toxic Substances</td>
<td>21,22</td>
<td>21,22</td>
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<td></td>
<td>In-class Quiz 5 (On Week 6)</td>
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<tr>
<td>8</td>
<td>TUE Mar 12</td>
<td>Nutrition, Vitamins, Tumor Markers, Geriatric and Pediatrics</td>
<td>23,24,</td>
<td>23,24,</td>
<td>HW 6 due (dropbox by 9am)</td>
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<td>10</td>
<td>25,26</td>
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<td></td>
<td>Thu Mar 14</td>
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</table>

**CUMULATIVE LECTURE FINAL**
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Unit</th>
<th>Assignments/Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>THU Jan 24</td>
<td>Safety, Glassware, Pipetting, Dilutions and Reagents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TUE Jan 29</td>
<td>Spectrophotometer/Beer’s law</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>THU Jan 31</td>
<td>Statistics, Quality Control and Levy Jennings</td>
<td>Week 1 HW due (dropbox by 9am)</td>
</tr>
<tr>
<td></td>
<td>TUE Feb 5</td>
<td>Laboratory Math</td>
<td></td>
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<tr>
<td></td>
<td>THU Feb 7</td>
<td>Detecting the Silent Killer: Clinical Diagnosis of Diabetes</td>
<td>Week 2 HW due (dropbox by 9am)</td>
</tr>
<tr>
<td>3</td>
<td>TUE Feb 12</td>
<td>Protein Electrophoresis</td>
<td>In-class Quiz 1 (On Weeks 1-3)</td>
</tr>
<tr>
<td></td>
<td>THU Feb 14</td>
<td>Principles of Enzyme Catalysis</td>
<td>Week 3 HW due (dropbox by 9am)</td>
</tr>
<tr>
<td>4</td>
<td>MIDTERM</td>
<td>MIDTERM (Weeks 1-4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WEEK</td>
<td>TUES FEB 19- LAB- Review Session (Optional)</td>
<td></td>
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<tr>
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<td>THU FEB 21-LAB – LAB MIDTERM</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>TUE Feb 26</td>
<td>Creatinine Clearance Blood gases, pH, Acid-Base Balance Case Studies</td>
<td>Week 4 HW due (dropbox by 9am)</td>
</tr>
<tr>
<td></td>
<td>THU Feb 28</td>
<td>Pregnancy Tests Case Studies</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>TUE Mar 5</td>
<td>Cardiac, Liver, and Iron studies Principles of Thin Layer Chromatography</td>
<td>Week 6 HW due (dropbox by 9am)</td>
</tr>
<tr>
<td></td>
<td>THU Mar 7</td>
<td>Urine Toxicology and Clinical Measurement</td>
<td>In-class Quiz 2 (On Week 6)</td>
</tr>
<tr>
<td>8</td>
<td>TUE Mar 12</td>
<td>Lab. Presentations</td>
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<td></td>
<td>THU Mar 14</td>
<td>LAB FINAL</td>
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<tr>
<td>Week</td>
<td>Date</td>
<td>Unit</td>
<td>2nd Ed</td>
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</tr>
<tr>
<td>1</td>
<td>Advise getting a head start</td>
<td>Laboratory Basics &lt;br&gt;Safety in the Clinical Chemistry Lab.</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Start: Tues 1/21/20 &lt;br&gt;End: Mon 1/27/20</td>
<td>Instrumentation, Laboratory Automation and Informatics</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Start: Sun 1/26/20 &lt;br&gt;End: Mon 2/3/20</td>
<td>Laboratory Statistics, Method development and QC &lt;br&gt;Immunoassays, Molecular Diagnostics</td>
<td>3-6</td>
</tr>
<tr>
<td>3</td>
<td>Start: Sun 2/2/20 &lt;br&gt;End: Mon 2/10/20</td>
<td>Carbohydrates, Lipids and Lipoproteins &lt;br&gt;Amino Acids, Proteins and Enzymes</td>
<td>7-10</td>
</tr>
<tr>
<td>4</td>
<td>Start: Sun 2/9/20 &lt;br&gt;End: Mon 2/17/20</td>
<td>Non-protein nitrogen, Renal Function, Body water and Electrolyte Homeostasis</td>
<td>11-12</td>
</tr>
<tr>
<td>5</td>
<td>MIDTERM WEEK</td>
<td>MIDTERM (Weeks 1-4) &lt;br&gt;Take between Sat 2/15/20 - Sat 2/22/20 Proctoring Service or MCCC Testing Center</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Start: Sun 2/16/20 &lt;br&gt;End: Mon 2/24/20</td>
<td>The Endocrine System, Gastrointestinal Function, Pancreas, and Cardiac Function</td>
<td>15-18</td>
</tr>
<tr>
<td>7</td>
<td>Start: Sun 3/1/20 &lt;br&gt;End: Mon 3/9/20</td>
<td>TDM and Toxic Substances &lt;br&gt;Nutrition, Vitamins, Tumor Markers &lt;br&gt;Geriatric and Pediatrics</td>
<td>21-26</td>
</tr>
<tr>
<td>8</td>
<td>FINALS WEEK</td>
<td>SIMULATION &lt;br&gt;TAKE FINAL EXAM between Saturday 3/7/20-Thursday 3/12/20</td>
<td></td>
</tr>
</tbody>
</table>
# MLT 200: Clinical Chemistry Hybrid SAMPLE Lab Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Daily Agenda</th>
<th>Assignments/Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WED Jan 22</td>
<td><strong>Morning</strong> Safety, Glassware, Pipetting, Dilutions and Reagents  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Afternoon</strong> Spectrophotometer/Beer’s law</td>
<td>Quiz 1  &lt;br&gt; Week 1 HW due  &lt;br&gt; (dropbox by Wed midnight)</td>
</tr>
<tr>
<td>2</td>
<td>WED Jan 29</td>
<td><strong>Morning</strong> Statistics, Laboratory Math and QC  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Afternoon</strong> Introduction to Automation –EKF Altair 240 Analyzer  &lt;br&gt; Preventative Maintenance, Calibration, QC/L-J Charts</td>
<td>Quiz 2  &lt;br&gt; Week 2 HW due  &lt;br&gt; (dropbox by Wed midnight)</td>
</tr>
<tr>
<td>3</td>
<td>WED Feb 5</td>
<td><strong>Morning</strong> Diagnosing Diabetes using an Immunoassay  &lt;br&gt; Measuring Glucose Levels (Altair)  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Afternoon</strong> Understanding Protein Electrophoresis  &lt;br&gt; Measuring Total Protein and Albumin (Altair)</td>
<td>Quiz 3  &lt;br&gt; Week 3 HW due  &lt;br&gt; (dropbox by Wed midnight)</td>
</tr>
<tr>
<td>4</td>
<td>WED Feb 12</td>
<td><strong>Morning</strong> Creatinine Clearance and Osmoalilty  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Afternoon</strong> Case Studies (Glucose, Cholesterol, Kidney)  &lt;br&gt; Renal and Electrolyte panel testing (Altair)</td>
<td>Quiz 3  &lt;br&gt; Week 3 HW due  &lt;br&gt; (dropbox by Wed midnight)</td>
</tr>
<tr>
<td>4</td>
<td>MIDTERM WEEK WED Feb 19</td>
<td><strong>Morning 9:00am-11:00am</strong> Lab Midterm  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Afternoon (Noon-3:00pm)</strong> hCG testing  &lt;br&gt; Cardiac Enzyme Marker Testing (Triage MeterPro/Altair)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>WED Feb 26</td>
<td>Case Studies of Organs (Heart, Pancreas, Liver)  &lt;br&gt; Blood Gasses  &lt;br&gt; Analyzer Presentations due</td>
<td>Week 4 HW due  &lt;br&gt; (dropbox by 3/6/19 9am)</td>
</tr>
<tr>
<td>5</td>
<td>VIRTUAL LAB (RECORDED SESSION)</td>
<td></td>
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<tr>
<td>6</td>
<td>WED March 4</td>
<td><strong>Morning</strong> Blood Gasses Review  &lt;br&gt; Thin Layer Chromatography (TLC)  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Afternoon</strong> Drugs of Abuse Testing (Toxicology)</td>
<td>In-person Quiz 2  &lt;br&gt; (On Week 3 and 5)  &lt;br&gt; Week 5 HW due  &lt;br&gt; (dropbox by 3/13/19 9am)</td>
</tr>
<tr>
<td>7</td>
<td>WED March 11</td>
<td><strong>Morning</strong> SIMULATION  &lt;br&gt; <strong>Lunch</strong>  &lt;br&gt; <strong>Lab FINAL (1pm-3pm)</strong></td>
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</tbody>
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