



Course Syllabus

MLAB 1227- Coagulation

Catalog Description: A course in coagulation theory, procedures, and practical applications. Includes quality control, quality assurance, safety and laboratory procedures which rely on commonly performed manual and/or semi-automated methods.

Lecture hours = 2, Lab hours = 1

Prerequisites: Enrollment in this course and the Medical Laboratory Technology Program requires department head approval and successful completion of the admissions process. Students must be accepted into the MLT Program.

Semester Credit Hours: 2

Lecture Hours per Week: 2

Lab Hours per Week: 1

Contact Hours per Semester: 80

State Approval Code: 5110040000

Instructional Goals and Purposes: The purpose of this course is to cover coagulation theory, procedures, and practical applications. The laboratory exercises will endeavor to provide the student with the most comprehensive experiences possible. This will rely mainly on the commonly performed manual and semi-automated methods of coagulation with an emphasis on quality control, quality assurance, and safety.

Learning Outcomes:

1. Apply principles of safety, quality assurance and quality control in coagulation.
2. Evaluate specimen acceptability.
3. Compare and contrast coagulation processes under normal and abnormal human conditions.
4. Perform basic laboratory coagulation analysis
5. Evaluate laboratory test results and correlate with patient condition(s).

Specific Course Objectives (includes SCANS):

After studying all materials and resources presented in the course, the student will be able to:

1. **Intro/Cascade (1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. Define Hemostasis.
 - b. List and define the five stages of hemostasis.
 - c. Differentiate between *in vitro* and *in vivo*.
 - d. Explain how Fibrinogen is converted to Fibrin.
 - e. Discuss how the clot is stabilized in the cascade.
 - f. Discuss how the Intrinsic and Extrinsic Pathways are activated.
 - g. Discuss the role of Calcium in the Coagulation Cascade.
 - h. Trace the coagulation pathway through both the Intrinsic and Extrinsic Pathways (give the numbers and common names of the factors).
 - i. Define hemostasis.
 - j. Explain how Prothrombin is converted to Thrombin
2. **Chapter 25 (1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. Describe the components of bleeding and clotting mechanisms.
 - b. Describe and compare the histological features of the tissues of the arteries and veins.
 - c. Name the blood vessels that constitute the microcirculation and compare their size and other features with those of arteries and veins.

- d. Define the term vasoconstriction.
 - e. Explain how vasoconstriction participates in hemostasis.
 - f. Describe the metabolic activity of the endothelium and its role in hemostasis.
 - g. Outline the general process of hemostasis in small vessels that contributes to the maintenance of vascular integrity.
 - h. Define the term endoreduplication and relate this process to megakaryocytic development.
 - i. List and explain the three functions of thrombopoietin or thrombopoietin-like cytokines.
 - j. Describe the morphological features of the mature stages of development in the megakaryocyte series.
 - k. Describe the process of formation of platelets from a megakaryocyte.
 - l. List the ultrastructural components and cytoplasmic constituents of a mature platelet and describe the overall function of each.
 - m. Explain the life span activities of a mature platelet.
 - n. Explain the function of platelets in response to vascular damage.
 - o. Define generally the terms platelet adhesion and platelet aggregation.
 - p. Explain the events that take place during platelet adhesion, including the substances produced.
 - q. Explain the events that take place during platelet aggregation.
 - r. List substances that promote and substances that inhibit some aspects of platelet aggregation.
 - s. Briefly describe the process of platelet plug consolidation and stabilization.
- 3. Chapter 27 (1a-i, ii, iv, v, 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v, 2a-i, iii. 2c-i, ii, iii, iv.)**
- a. Explain the procedure for naming the coagulation factors.
 - b. List the principal coagulation factors.
 - c. Name the three groupings of coagulation factors and describe their similarities.
 - d. Describe the individual functional characteristics of each of the coagulation factors.
 - e. Name the four basic phases of blood coagulation.
 - f. Describe the sequence of events in the extrinsic pathway.
 - g. Describe the sequence of events in the intrinsic pathway.
 - h. Describe the sequence of events in the common coagulation pathway.
 - i. Describe the importance of vitamin K in hemostasis.
 - j. Define the term fibrinolysis, and describe the major components of fibrinolytic system and why fibrinolysis is necessary.
 - k. Name and explain the principles of the basic and global laboratory tests that are used in assessing blood coagulation factors.
 - l. Explain the effect of normal blood flow and the removal of substances from the circulation on protecting the body from thrombosis.
 - m. Describe the activities of antithrombin as a normal body defense mechanism.
 - n. Name the two heparin-dependent thrombin inhibitors and describe their role as part of the natural anticoagulant system.
 - o. Describe the functions of protein C and protein S.
 - p. Explain the activities of the cellular proteases and the role of specific body cells in the production of coagulation factors and cofactors.
 - q. Name and describe the assay techniques that can be used for the detection of fibrin split products.
- 4. Chapter 32 (1a-i, ii, iv, v, 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v, 2a-i, iii. 2c-i, ii, iii, iv.)**
- a. Describe the specimen used for coagulation testing including tube, anticoagulant, ratio, and quality.
 - b. Describe how the intrinsic and extrinsic pathway are measured using coagulation testing.
 - c. Correlate the appropriate anticoagulant with the test that is used to measure and monitor patients using it.
 - d. Define the reagents used in aPTT testing.
 - e. Define the reagents used in PT testing.
 - f. Give the approximate normal range for PT and aPTT.
 - g. Describe the uses of the Antithrombin III test.
 - h. Describe the purpose of the bleeding time
 - i. Define substitution or mixing studies.
 - j. Define warfarin/Coumadin.

5. **Lab testing in Coagulation(1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. Define the purpose of TT.
 - b. Define the function of Factor XIII in the coagulation cascade.
 - c. Define and describe FDP.
 - d. List the causes of a prolonged aPTT in non-heparinized patients.
 - e. List the causes of a prolonged PT in patients not taking anticoagulants.
 - f. Give the approximate normal ranges of PT and INR.
 - g. Define and state the purpose of the INR.
6. **Coagulation Automation/Instrumentation Objectives (1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. Define the use of Thrombin Time (TT)
 - b. Discuss the uses of Platelet Aggregation studies and its relation to VWF
 - c. Discuss the different automation methods for clot detection.
 - d. Define turbidimetry, viscosity based detection, nephelometric clot detection, and platelet aggregometry.
7. **Chapter 26 (1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. Define the terms petechiae, ecchymoses, hematoma.
 - b. Define the term purpura and describe various vascular conditions that can produce this condition.
 - c. Describe the effect of mechanical force on blood vessels.
 - d. Define thrombocytopenia, thrombocytosis, and thrombocythemia.
 - e. Define the terms thrombocytopenia and thrombocytosis.
 - f. Cite at least two symptoms of thrombocytopenia.
 - g. Compare categories of platelet dysfunctions, including examples of disorders within each category.
 - h. Compare hereditary platelet adhesion and aggregation disorders: Bernard-Soulier syndrome, Glanzmann's thrombasthenia, storage granule abnormalities, and von Willebrand's disease.
 - i. Discuss secondary aggregation disorders: hereditary storage pool defect and hereditary aspirin-like defects.
8. **Chapter 28 (1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. Describe the relationship between hemostasis and blood coagulation.
 - b. Compare the mechanisms of vitamin K, severe liver disease, and renal disease on defective blood coagulation factor production.
 - c. Compare and contrast the X-linked disorders of secondary hemostasis: factor VIII and factor IX deficiencies.
 - d. Compare the laboratory findings for factor VIII and factor IX deficiencies and von Willebrand's disease.
 - e. Compare primary and secondary fibrinolysis.
 - f. Explain the conditions and laboratory findings in conditions of disseminated intravascular coagulation (DIC) and fibrinolysis.
 - g. Define the term thrombophilia.
 - h. Name and compare primary states of hypercoagulability.
 - i. Explain the role of vascular damage and blood flow in the hypercoagulable state.
 - j. Detail how platelets contribute to hypercoagulation.
 - k. Compare the molecular and functional assays for diagnosis of antithrombin, protein C and protein S abnormalities.
 - l. Describe how activated protein C contributes to thrombophilia.
 - m. Describe the activity of blood coagulation factors in increasing the tendency toward thrombosis.
 - n. Explain the characteristic and laboratory findings in antiphospholipid syndrome.
 - o. Describe the relationship between impaired fibrinolysis and protein C, antithrombin, and plasminogen.
 - p. Describe the laboratory assessments that illustrate the condition of hypercoagulation.
 - q. Discuss various categories of anticoagulant therapy.
9. **Clotting Disorders (1a-i, ii, iv, v. 1b-ii, iii, iv, v, vi. 1c-i, ii, iv, v. 2a-i, iii. 2c-i, ii, iii, iv.)**
 - a. List the three causes of acquired clotting disorders.
 - b. Name the most common form of Hemophilia.
 - c. Define thrombocytopenia.

- d. Define the disorder caused by lack of or ineffective VIII:C.
- e. Define the disorder caused by defective Factor IX.
- f. Name the disorder caused by deficiency of Factor V.

10. Lab #1 (1a-i, ii, iv, v. 1b-ii, iii, iv, v. 1c-i, ii, iii, iv, v. 2a-i, iii. 2b-i ii, iv, v, vi. 2c-i, ii, iii.)

- a. Describe and name different PPE (Personal Protective Equipment).
- b. Define and practice universal precautions.
- c. Know and understand the equation for the creation of Thrombin in the body.
- d. Know and understand the equation for the creation of Fibrin in the body.
- e. Describe and differentiate the Intrinsic and Extrinsic coagulation pathways.
- f. Know the anticoagulant used for coagulation studies in the lab and describe its mechanism of action.
- g. Know the different physical factors that can effect clotting.
- h. Describe the effect of calcium carbonate on blood IN VITRO.
- i. Understand how the clotting system works and how the system is activated.
- j. Differentiate clotting time and bleeding time.

11. Lab #3 (1a-i, ii, iv, v. 1b-ii, iii, iv, v. 1c-i, ii, iii, iv, v. 2a-i, iii. 2b-i ii, iv, v, vi. 2c-i, ii, iii.)

- a. Describe what is done in a protime test.
- b. Know the appropriate test to measure the therapeutic range of coumadin.
- c. Know the appropriate test to measure the therapeutic range of heparin.
- d. Know where fibrin and other coagulation factors are manufactured.
- e. Describe DIC.
- f. Know what FDP is- give an example.
- g. Know the conditions the D-Dimer test can help diagnose.

Course Content:

A general description of lecture/discussion topics included in this course are listed in the Learning Objectives / Specific Course Objectives sections of this syllabus.

Students in all sections of this course will be required to do the following:

1. Demonstrate an understanding of the coagulation mechanism by explanation and demonstration.
2. Understand abnormalities and disease states of coagulation.
3. Understand basic laboratory coagulation analysis.
4. Demonstrate competent handling of blood specimens according to OSHA Safety regulation.
5. Understand and determine suitability of coagulation specimens.

Methods of Instruction/Course Format/Delivery:

This is a mainly online course so it will require a lot of outside proactive work by the student. The instructor will provide guidance as needed. The student will be evaluated by assignments and quizzes outside of the classroom.

The student will be required to come to a Panola College testing Center to take all major examinations. Laboratories will take place on three pre-determined Saturdays during the semester and will be mandatory. During the laboratories the students will be evaluated by case studies, in-lab assignments, and lab practicals as assigned by the instructor.

Major Assignments / Assessments:

The following items will be assigned and assessed during the semester and used to calculate the student's final grade.

Assignments

1. Chapters 23, 24, 26
2. Coagulation Cascade
3. Pre-Lab
4. Quizzes

Assessment(s):

1. 3 Major Exams
2. Post Lab quiz
3. Final Exam

Course Grade:

The grading scale for this course is as follows:

- Lecture Grade = 2/3 of grade
- Lab Grade = 1/3 of grade

Lecture

- Major Exams 50%
- Quizzes 15%
- Homework Assignments 20%
- Final Exam 15%

Laboratory

- Pre-Lab Quizzes 10%
- Case Assignments 20%
- In-Lab Assignments 20%
- Practicals 50%

Texts, Materials, and Supplies:

- *Turgeon, Mary Louise. (2017). Clinical Hematology: Theory & Procedures 6th ed. Baltimore: Lipincott Williams & Wilkins. ISBN 9781496332288*

Required Readings:

- *Turgeon, Mary Louise. (2017). Clinical Hematology: Theory & Procedures 6th ed. Baltimore: Lipincott Williams & Wilkins. ISBN 9781496332288*

Recommended Readings:

- Medical Dictionary
- www.labtestsonline.org

Other:

- For current texts and materials, use the following link to access bookstore listings: <http://www.panolacollegestore.com>
- For testing services, use the following link: <http://www.panola.edu/elearning/testing.html>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Administration Building or go to <http://www.panola.edu/student-success/disability-support-services/> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*: <http://www.panola.edu/student-success/documents/pathfinder.pdf>

Laboratory Dress Code

The student will be expected to attend class clean and neatly dressed in long pants or scrubs and wear closed-toe shoes. A laboratory coat will must be worn snapped or buttoned up during all laboratory sessions. Hair that is shoulder length or longer must be worn up or securely tied back. Gloves must be worn when handling biological materials.

Behavioral Conduct

While a student is representing Panola College as a Medical Laboratory Technology student, they will be expected to conduct themselves in such a manner as to reflect favorably on themselves and on the

Program. If a student acts in such a manner as to reflect immature judgment or disrespect for others, the student will be called before the MLT Department Chair for determination of their status in the Program. Inappropriate conduct is grounds discipline and may be cause for immediate probation or dismissal from the Program.

Academic Dishonesty

Under no circumstances shall a student submit work that is not their own. Copying answers for study questions, cheating on exams and/or submitting laboratory results which are not your own are expressly prohibited.

Time Commitment

According to "Hints on How to Succeed in College Classes"

<http://astrosociety.org/edu/resources/success.html> you should budget your time per week for this two hour credit course as follows:

1. Reading assigned text 1 to 2 hours
2. Homework assignments 3 to 5 hours
3. Time for review and test preparation 2 hours
4. Total study time per week 6 to 9 hours PER WEEK

SCANS CRITERIA

1) **Foundation skills are defined in three areas: basic skills, thinking skills, and personal qualities.**

- a) **Basic Skills:** A worker must read, write, perform arithmetic and mathematical operations, listen, and speak effectively. These skills include:
 - i) Reading: locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
 - ii) Writing: communicate thoughts, ideas, information, and messages in writing, and create documents such as letters, directions, manuals, reports, graphs, and flow charts.
 - iii) Arithmetic and Mathematical Operations: perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
 - iv) Listening: receive, attend to, interpret, and respond to verbal messages and other cues.
 - v) Speaking: Organize ideas and communicate orally.
- b) **Thinking Skills:** A worker must think creatively, make decisions, solve problems, visualize, know how to learn, and reason effectively. These skills include:
 - i) Creative Thinking: generate new ideas.
 - ii) Decision Making: specify goals and constraints, generate alternatives, consider risks, and evaluate and choose the best alternative.
 - iii) Problem Solving: recognize problems and devise and implement plan of action.
 - iv) Visualize ("Seeing Things in the Mind's Eye"): organize and process symbols, pictures, graphs, objects, and other information.
 - v) Knowing How to Learn: use efficient learning techniques to acquire and apply new knowledge and skills.
 - vi) Reasoning: discover a rule or principle underlying the relationship between two or more objects and apply it when solving a problem.
- c) **Personal Qualities:** A worker must display responsibility, self-esteem, sociability, self-management, integrity, and honesty.
 - i) Responsibility: exert a high level of effort and persevere toward goal attainment.
 - ii) Self-Esteem: believe in one's own self-worth and maintain a positive view of oneself.
 - iii) Sociability: demonstrate understanding, friendliness, adaptability, empathy, and politeness in group settings.
 - iv) Self-Management: assess oneself accurately, set personal goals, monitor progress, and exhibit self-control.
 - v) Integrity and Honesty: choose ethical courses of action.

2) **Workplace competencies are defined in five areas: resources, interpersonal skills, information, systems, and technology.**

- a) **Resources:** A worker must identify, organize, plan, and allocate resources effectively.
 - i) Time: select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
 - ii) Money: Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
 - iii) Material and Facilities: Acquire, store, allocate, and use materials or space efficiently. Examples: construct a decision time line chart; use computer software to plan a project; prepare a budget; conduct a cost/benefits analysis; design an RFP process; write a job description; develop a staffing plan.
- b) **Interpersonal Skills:** A worker must work with others effectively.
 - i) Participate as a Member of a Team: contribute to group effort.
 - ii) Teach Others New Skills.
 - iii) Serve Clients/Customers: work to satisfy customer's expectations.

- iv) **Exercise Leadership:** communicate ideas to justify position, persuade and convince others, responsibly challenge existing procedures and policies.
- v) **Negotiate:** work toward agreements involving exchange of resources, resolve divergent interests.
- vi) **Work with Diversity:** work well with men and women from diverse backgrounds.

Examples: collaborate with a group member to solve a problem; work through a group conflict situation, train a colleague; deal with a dissatisfied customer in person; select and use appropriate leadership styles; use effective delegation techniques; conduct an individual or team negotiation; demonstrate an understanding of how people from different cultural backgrounds might behave in various situations.

- c) **Information:** A worker must be able to acquire and use information.

- i) **Acquire and Evaluate Information.**
- ii) **Organize and Maintain Information.**
- iii) **Interpret and Communicate Information.**
- iv) **Use Computers to Process Information.**

Examples: research and collect data from various sources; develop a form to collect data; develop an inventory record-keeping system; produce a report using graphics; make an oral presentation using various media; use on-line computer data bases to research a report; use a computer spreadsheet to develop a budget.

- d) **Systems:** A worker must understand complex interrelationships.

- i) **Understand Systems:** know how social, organizational, and technological systems work and operate effectively with them.
- ii) **Monitor and Correct Performance:** distinguish trends, predict impacts on system operations, diagnose deviations in systems' performance and correct malfunctions.
- iii) **Improve or Design Systems:** suggest modifications to existing systems and develop new or alternative systems to improve performance.

Examples: draw and interpret an organizational chart; develop a monitoring process; choose a situation needing improvement, break it down, examine it, propose an improvement, and implement it.

- e) **Technology:** A worker must be able to work with a variety of technologies.

- i) **Select Technology:** choose procedures, tools or equipment including computers and related technologies.
- ii) **Apply Technologies to Task:** understand overall intent and proper procedures for setup and operation of equipment.
- iii) **Maintain and Troubleshoot Equipment:** Prevent, identify, or solve problems with equipment, including computers and other technologies.

Examples: read equipment descriptions and technical specifications to select equipment to meet needs; set up and assemble appropriate equipment from instructions; read and follow directions for troubleshooting and repairing equipment.