MERCER COUNTY COMMUNITY COLLEGE

COURSE OUTLINE

MLT 115 Course Number	4 Credits
Hematology Class Title	3 Class Hours
Science and Allied Health Division	3 Laboratory Hours

Texts:
Title: Hematology Clinical Procedures and Applications
Author: Bernadette F. Rodak
Publisher: W.B. Saunders Co.

Title: Clinical Hematology Atlas
Author: Carr, Rodak
Publisher: Saunders

Methods of Instruction: Lecture, discussion, audio-visual media, college laboratory

Methods of Evaluation: Assignments, quizzes, examinations, college laboratory performance

Revised 2004

7 ½ Weeks
Length of Semester

Catalog Description
MLT 115 – Hematology **4 credits**
Prerequisite: MLT 112

Hematology and blood circulation, including blood cell maturation; physiology and morphology; hemostasis theory; and procedures. Laboratory component develops skills used in the performance of hematology and coagulation lab analysis.

3 lecture/laboratory hours

Instructor: Lecture/Lab – Cheryl Peebles – MS 230 – 586-4800, ext. 3542
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Course Objectives – MLT 115 – Hematology

1. Understand the principles of Hematology. Define hematopoiesis, quality assurance, quality control and use statistical data in the hematology and coagulation laboratories.

2. Define erythropoiesis. Understand the development and maturation of hemoglobin and its association with the erythrocytic cycle. Know the criteria and be able to identify normal and abnormal erythrocytes. Apply this knowledge to laboratory values observed in the CBC, red cell indices and the reticulocyte count. Correlate lab results with anemia classifications.

3. Discuss the development and maturation cycle of the leukocytes. Describe the nuclear and cytoplasmic characteristics of the granulocytes, monocytes and lymphocytes and recognize the normal and abnormal cells of each leukocyte line. Apply this knowledge to reading blood smear differentials and correlate lab results with leukemoid and leukemia classifications.

4. Understand the theory, principle and test procedures of coagulation testing.

Laboratory – Exit Level Skills

1. Demonstrates proficiency in the enumeration of cellular elements.

    a. Given blood samples the student will perform replicate manual CBC evaluations.

    b. Given automated CBC reports and accompanying blood smears, the student will evaluate simulated clinical case studies.

2. Perform differential smear evaluations on:

    a. normal blood smears
    b. abnormal blood smears

<u>Coagulation</u>

1. Given blood specimens the student will perform coagulation studies including:
    prothrombin time
    partial thromboplastin time

2. Using the results obtained in coagulation studies, the student will identify the possible factor or factors involved in the abnormal specimens.

Suggested Additional References

Miale, John B. Laboratory Medicine-Hematology

Harmening: Hematology

Dade Monographs: Coagulation Procedures
The Coagulation Factors
Fibrinogen and Fibrinolysis

Lotspeich: Clinical Hematology

Grading Policy

1. To receive an acceptable passing grade, the student must meet the following criteria:

   a. Achieve the following minimum number of points in each section of the course:

Minimum lecture points	322
Minimum laboratory points	168

      The final grade will not be computed unless the minimum points are achieved in each portion of the course that is, the lecture portion, and the laboratory portion.

2. A final grade of "C" or better in each Medical Laboratory Technician course is necessary to progress to the next MLT course and to graduate.

3. If any part of the course, that is, the lecture part, or the laboratory part is failed, the student must repeat the entire course.

4. If the student receives the minimum number of points in each section of the course as listed in "a" above (the lecture of the laboratory) then the final grade is computed as follows:

   total lecture points
   plus total laboratory points = Final Grade

GRADE POINTS ARE COMPUTED AS FOLLOWS:

Total Lecture Points

3 Hour tests total points	=	300 pts. maximum
7 quizzes	=	60 pts. maximum
Comprehensive Final	=	100 pts. maximum
Lecture Total		460 pts. maximum

Total Laboratory Points

12 Lab questions – 5 points each	=	60 pts. maximum
2 procedural mini practicals (40 points each) total	=	80 pts. maximum
Comprehensive lab practical score	=	100 pts. maximum
Laboratory Total		240 pts. maximum

Laboratory Total

There are no make-up labs. Absence from lab will deduct 5 points from the total lab score. Lateness to lab will deduct 2 points from the total lab score. Students will not be allowed to take a quiz if they come in late after the quiz is started.

Final Grade

A = 700-651	C+ = 559-539
A- = 650-630	C = 538-490
B+ = 629-609	D = 489-420
B = 608-581	F = below 420
B- = 580-560	

Academic Integrity Policy:

Any student who (1) knowingly represents work of others as his/her own, (2) uses or obtains unauthorized assistance in the execution of any academic work, and (3) gives fraudulent assistance to another, is guilty of cheating. Violators will be penalized in accordance with established college policies and procedures.

Hematology Lecture Schedule

Week 1 HEMATOLOGY

- Hematology Overview
- Morphology and Function of Cellular Components
- Hematopoietic Theory

HEMATOLOGY PROCEDURES

- Hemacytometer – manual counts
- Hemoglobin and Hematocrit
- ESR
- Reticulocyte
- Hemoglobin S – solubility test

Week 2 ERTHROCYTE

- Production
- Controlling factors
- Apoptosis
- Erythropoiesis
- RBC membrane
- RBC hemolysis
- RBC metabolism

HEMOGLOBIN

- Hemoglobin structure
- Hemoglobin synthesis
- Hemoglobin function
- Normal/abnormal hemoglobin

ERTHROCYTE MORPHOLOGY

- Poikilocytosis and anisocytosis
- RBC indices
- RBC inclusions
- Bone marrow and RBC production

Week 3 LEUKOCYTE

- Leukopoiesis
- Granulocytic maturation
- Monocytic/macrophage maturation
- Lymphocytic maturation

ANEMIAS

- Classification of anemias (MCV & pathophysiology)
- Anemia of iron metabolism
- Iron deficiency anemia
- ACD
- Sideroblastic anemia
- Caused by defects of DNA metabolism

APLASTIC ANEMIA

- Bone marrow failure

Week 4 HEMOLYTIC ANEMIAS

- Intro to hemolytic anemias
- Increase RBC destruction (intracorpuscular)
- Increase RBC destruction (extracorpuscular)
- Immune causes of RBC destruction

HEMOGLOBINOPATHIES
THALLESEMIAS

LEUKOCYTES-LEUKEMIA

- Qualitative alterations of leukemia
- Quantitative alterations of leukemia
- Cytochemistry study of leukemia
- Immunochemistry of leukemia
- Cytogenetics of leukemia
- Molecular diagnosis of leukemia

Week 5 LEUKOCYTE DISORDERS (continued)

- Malignant disorders of leukocytes
- Acute leukemia
- Chronic leukemia
- Myeloproliferative disorders
- Lymphoprohiferative disorders
- Flow cytometry
- Body fluids

Week 6 COAGULATION

- Hemostasis and coagulation
- Disorders of hemostasis

Week 7 PLATELETS

- Platelet disorders
- Disorders of thrombosis

EVALUATION OF HEMOSTASIS

INSTRUMENTATION IN COAGULATION

HEMATOLOGY LABORATORY SCHEDULE

Week 1 – Review safety and phlebotomy
Microscopic care and cleaning
Automated CBC and quality control
Prepare peripheral smears
Hemacytometer
PLT count – by unopette
hgb, hct, indices

Week 2 – Normal and abnormal morphology
Retic count, ESR and sickle cell

Week 3 – Mini Practical #1 (Tuesday)
Normal differential smears

Week 4 – Normal differential smears
WBC/PT estimation
Abnormal differentials

Week 5 – Abnormal differentials
Corrected CBC
Body fluid evaluation (manual WBC)

Week 6 – Abnormal differentials
Mini Practical #2 (Lab 11)

Week 7 – Coagulation testing
Fibrometer/Automation

Week 8 – Comprehensive Lab Practical

WEEK 1

Knowledge Objectives: The student should be able to:

1. Describe the composition of blood and define the function of erythrocytes, leukocytes, and platelets.

2. Identify the normal reference ranges for hemoglobin, hematocrit, erythrocytes, and leukocytes for adult, infant and children.

3. Understand basic cell morphology.

4. Identify sites of hematopoiesis.

5. Discuss the principle of the hemacytometer and test procedures and values for hemoglobin, hematocrit, indices and retic counts.

6. Review standard procedures for preparing, staining, and evaluating a peripheral blood smear.

7. Describe the principle of cell enumeration and identification using hematology instruments.

8. Know the principles of impedance and optical light scattering.

Performance Objectives

1. Perform and evaluate: automated CBC and instrument Q.C.

2. Correlate hemoglobin and hematocrit results with RBC indices to classify anemias.

3. Prepare and stain blood smears.

4. Perform manual platelet count using the Unopette technique.

Assignment

Rodak: Ch. 5 and 6
Ch. 13, 40, 14

WEEK 2

Knowledge Objectives: The student should be able to:

1. List the stages of erythrocyte maturation.
2. Identify normal erythrocyte stages.
3. Describe the synthesis and structure of hemoglobin.
4. Identify normal and abnormal hemoglobin patterns.
5. Discuss and describe the terms, anisocytosis and poikilocytosis. Identify CBC inclusions.
6. Correlate RBC values with reticulocyte counts and classify anemias with correlation of RBC count, hemoglobin, hematocrit and RBC indices values.

Performance Objectives

1. Perform blood smears for RBC morphology and evaluation.
2. Perform sickle cell sed rates.
3. Perform manual retic procedures.

Assignment

Rodak: Ch. 7, 8, 9
Ch. 16, 15

WEEK 3

Knowledge Objectives: The student should be able to:

1. Describe the development, maturation, and function of the granulocytic, monocytic-macrophage, and the lymphocytic cell lines.

2. Classify different types of anemias.

3. Define the term, hemoglobinopathic.

4. Identify characteristics, clinical and laboratory findings in various disease conditions: sickle cell anemia, hemoglobin C/SC disease, and thalassemias.

5. Describe the blood smear morphology observed in thalassemias.

Performance Objectives

1. Review RBC morphology.

2. Begin evaluation of normal blood smear differentials.

Assignments

Rodak: Ch. 11
Ch. 16, 10, 17, 18, 19, 20
24 and 25

WEEK 4

Knowledge Objectives: The student should be able to:

1. Identify the characteristics and morphology of macrocytic anemias.
2. Differentiate megaloblastic and non megaloblastic macrocytic anemias.
3. Define the role of vitamin B12 and folic acid in megaloblastic anemias.
4. Define hypopioliferative anemia.
5. List the characteristics and morphology of aplastic anemia including bone marrow examination.
6. Understand RBC membrane defects, enzyme deficiency, autoimmune processes, and correlate this knowledge with RBC morphology in hemolytic anemias.
7. Describe the laboratory findings of various conditions affecting the morphology of neutrophils, granulocytes, and their inclusion, eosinophils, basophils, and monocyte disorders.
8. Differentiate between normal lymphs, lymphocytosis, and reactive lymphocytes.
9. Classify the different types of leukemia based on morphology, special stains, flow cytometry and bone marrow evaluation.
10. Identify the cell morphology associated with various myeloproliferative disorders.

Performance Objectives

1. Perform normal blood smear differentials.
2. Begin evaluation of abnormal blood smear differentials.

Assignments

Rodak: Ch. 20, 21, 22, 23, 24, 25
Ch. 29, 30, 31

WEEK 5

Knowledge Objectives: The student should be able to:

1. Define the term, myelodysplastic syndrome and state their major laboratory findings.

2. Define acute leukemia and differentiate between acute myelogenous leukemia (AML) and acute lymphocytic leukemia (ALL), recognizing the peripheral blood smear morphology for each and bone marrow findings for each.

3. Describe the routine tests that are performed on common body fluids.

4. Recognize WBC and RBC by manual cell counts on the hemacytometer for the body fluids.

5. Understand the evaluation of a smear of body fluid prepared on a cytocentrifuge.

Performance Objectives

1. Continue abnormal blood smear evaluation.

2. Discuss corrected WBC counts.

3. Perform manual cell counts of body fluids.

Assignments

Rodak: Ch.35, 36, 37, 38, 39, 41

WEEK 6

Knowledge Objectives: The student should be able to:

1. Define the terms hemostasis, blood coagulation and thrombosis.
2. Identify the role and function of the blood vessels and platelets in primary hemostasis.
3. Differentiate primary and secondary hemostasis.
4. List the coagulation factor.
5. Discuss the reactions found in the intrinsic, extrinsic, and common pathways of the coagulation cascade.
6. Define fibrinolysis and state its role in hemostasis.

Performance Objectives

1. Continue evaluation of abnormal blood smear differentials.
2. Review of normal and abnormal blood smear differentials.

Assignments

McKenzie: Ch. 34-35

WEEK 7

Knowledge Objectives: The student should be able to:

1. Identify laboratory tests used to evaluate primary hemostasis disorders. This includes tests for thrombocytes (platelets) and their clinical correlation to petechiae, purpura, ecchymosis, hematoma and bruising.

2. Explain the effects of aspirin on platelets.

3. Identify laboratory tests used to evaluate secondary hemostasis disorders (leading to fibrin clot). Correlate test results with common disorders, hemophilia A and B, DIC, von Willebrand disease and Lupus centicoagulant.

4. Define the terms hypercoagulability, thrombophilia, thrombus and thrombasis.

5. Define deep vein thrombasis.

6. Correlate the findings of protein C and protein S and deep vein thrombosis.

7. State the principle of each of the following tests performed for coagulation studies: bleeding time, prothrombin time, activated partial thromboplastin time, thrombin time, fibrinogen assay, fibrin degradation products and D-dimer assays.

8. Understand the calculation of the INR for the PT (prothrombin time).

Performance Objectives

1. Perform and evaluate coagulation test procedures and test results.

2. Correlate coagulation test results with common disease etiolysis.

3. Perform the comprehensive lab practical.

Assignments

Rodak: Ch. 42, 43, 44
Ch. 45, 46
Ch. 47, 48

MLT 115 GRADE EVALUATION

LECTURE

Hour test 1_____ (100 pts.)
2 _____ (100 pts.)
3 _____ (100 pts.) Total Test Score _____
Comprehensive
Final _____ (100 pts.)

Weekly Quiz Grade (10 pts. each – 5 questions)

Quiz 1 _____ 6 _____
2 _____ 7 _____ Total pts. possible 60 pts.
3 _____ (lowest score dropped)
4 _____
5 _____

Quiz pts. _____ Total Lecture Points _____

LABORATORY

Lab Questions 1 _____ 6 _____ 11. _____
(5 pts. each) 2 _____ 7 _____ 12. _____
3 _____ 8 _____
4 _____ 9 _____
5 _____ 10 _____ Lab Questions _____
(Total possible – 60)

Mini Practical 1 _____ (40 pts.)
Mini Practical 2 _____ (40 pts.) (Total possible – 80 pts.)
Comprehensive Lab Practical _____ (Total possible – 100)

Total _____

Total Lecture Points _____
Total Laboratory Points _____

_____ Total Points