Hematology and Blood Banking (Theory)

Total: 8hours /week
Lecture: 4 hours/week
Tutorial: 0 hour/week
Practical: 4 hours/week
Lab: 0 hours/week

Course Description
This course is designed to help trainees to develop knowledge and skills on hematopoietic, enumeration and identification of cells and conditions leading to alteration of normal values in health and diseases for routine hematological tests. This course also imparts knowledge to the students on anemia, blood disorders and blood parasites along with the principle of blood banking.

Course Objectives
After completion of this course of hematology the students will be able to;
- Perform routine and special laboratory procedures.
- Identify blood and blood cells disorders.
- Apply Blood Banking and Immunohematology techniques.

Course Content

Unit 1: Introduction to Hematology **6hrs**
- History, scope and importance of haematology.
- Review of circulatory system mentioning the functions of heart, arteries, veins and
- capillaries.
- Blood: definition,properties, composition, functions of each cells.
- Normal structure, shapes,sizes, life span and normal reference (values) of blood cells.

Unit 2: Haematopoiesis **10hrs**
- Definition; sites of blood formation.
- Development of blood cells
  - Erythropoiesis.
    - Stages of cell development
    - Regulation of erythropoiesis
    - Fate of RBC
  - Leucopoiesis
    - Myeloid series- stages of cell development
    - Lymphocytic series- stages of cell development
    - Monocytic series- stages of cell development
    - Regulation of leucopoiesis
  - Thrombopoiesis.
    - Stages of cell development
    - Regulation of platelet formation

Unit 3: Hemoglobin **9hrs**

- Hemoglobin: Definition, structure, function and normal range
- List of normal and abnormal haemoglobins.
- Haemoglobinopathies: Definition, examples
- Sickle cell anemia: Definition, cause and lab diagnosis
- Thalassemia: Definition, cause, types and lab diagnosis

Unit 4: Red Cell Disorders **13 hrs**

- Introduction to Qualitative, quantitative and morphological abnormalities of red cells.
- Anaemia: Definition, classification
- Definition, causes, symptoms, laboratory diagnosis and treatment of: Iron deficiency anemia; Megaloblastic anemia; Hemolytic anemia
- Polycythemia: Definition, causes, symptoms, diagnosis, and treatment.

Unit 5: White Blood Cell Disorders **8 hrs**

- Introduction to Morphological and functional disorders of white blood cells.
  - Introduction to Leucocytes disorders (Qualitative and Quantitative).
  - Leukemoid reaction: Definition, causes and lab diagnosis
  - Leukemia: Definition, causes, classification and lab diagnosis
  - Difference between Leukemoid reaction and Leukemia.

Unit 6: Platelet disorders **2hrs**

- Introduction, Definition and classification of platelet disorders

Unit 7: Coagulation mechanism **6 hrs**

- Haemostasis: Definition and components
- Coagulation factors
- Process of haemostasis and blood coagulation.
- Introduction to Bleeding disorders- Thrombocytopenia, Hemophilia

Unit 8: Hematological Techniques **55hrs**

- Introduction to Haematology laboratory instruments, equipments and glassware
- Anticoagulant: Definition, types based on mechanism of action, uses, advantage and disadvantages.
- Phlebotomy technique
  - Anatomical sites of blood sample collection
  - Methods of blood sample collection
    - Capillary blood sample collection
    - Venous blood sample collection
    - Arterial blood sample collection
  - Precaution during sample collection.

- Blood smear preparation: thick and thin.
- Hemocytometry: Principle, requirements, procedure, calculation, normal values,
- Clinical significance and precaution of
    - Total RBC Count
    - Total WBC Count
    - Platelet count
- Definition of stain. Principle, composition, Preparation, uses, procedure of
- Romanowsky stains (Wright's, Leishman's, and Giemsa stain).
    - Differential leukocyte count (DLC): principle, requirements, procedure, reference range, clinical significance and precaution.
- Absolute Eosinophil Count; Principle, requirements, procedure, reference range, clinical significance and precaution.
- Bone marrow examination: Sites of sample collection, smear preparation and staining (Giemsa stain)
- Erythrocyte Sedimentation Rate (ESR): Definition, principle, requirements, procedure, normal value, clinical significance and influencing factors of;
    - Wintrobe's method
    - Westergren method
- Packed cell volume (PCV):Definition, Principle, Clinical Significance, methods of estimation, Normal value, result, interpretation.
- Haemoglobin estimation:
    - Various methods of Hemoglobin estimation
    - Principle, requirements and procedure: Colorimetric method (Cyanmethaemoglobin) and Acid haematin method (Sahli's)
    - Clinical significance of Hemoglobin estimation
- Red cell indices (MCV,MCH, and MCHC) calculation, Normal value and their clinical significance.
- Reticulocyte count: Introduction, Principle, Procedure, Normal value, Clinical significance
- Introduction, Principle, Procedure, Normal values, Clinical significance for following tests; Bleeding time, clotting time, prothrombin time, activated partial thromboplastin time
- Automated blood cell analyzer; Working principle and application.
- Other Hematological techniques- LE Cell preparation, Osmotic Fragility Test, Sickling test, Hemoglobin electrophoresis
- Quality control in Hematology Laboratory.

Unit 9: Blood Parasites **6hrs**

- List out the Blood parasites with special reference to Nepal.
- Smear preparation, staining and identification of malarial parasite, microfilaria and LD bodies.

Unit 10: Immunohematology and Blood Banking **25hrs**

- Introduction. History, scope, importance.
- Instruments used in blood banking.

- Anticoagulants used in blood banking
- Blood grouping systems and various blood groups.
- Selection/rejection criteria for blood donor
- Blood donation: Donor preparation and procedure of blood collection, transport, processing and storage of blood.
- Blood components; their uses and storage.
- Theory, procedure, precaution and significance of
    - ABO and Rh blood grouping
    - Cross-matching
    - Direct and indirect Coomb's tests.
- Transfusion transmissible infections and their screening.
- Post transfusion reactions.
- Haemolytic disease of new born (Introduction, etiological factor, pathogenesis, clinical feature, lab diagnosis and management).

Reference books

- District Laboratory Practice in Tropical Countries- Monica Cheesburough, 2nd edition, Part 2
- Oxford handbook of Clinical Medicine- 10th edition
- Dacie and Lewis Practical haematology - 11th edition, Churchill Livingstone.
- De Gruchys clinical hematology in medical practice , 6th edition, Wiley India Pvt Ltd
- A hand book of Medical Laboratory Technology - V.H Talib,2nd edition, CBS Publisher
- Essentials of Hematology- Shirish M Kawthalkar, 3 rd edition, Jaypee
- Textbook of Pathology- Harsh Mohan. 8th edition, Jaypee
- Textbook of Medical Laboratory Technology, Clinical laboratory Science And Molecular Diagnosis-Praful B. Godkar,3rd edition, vol,2
- Manual of basic techniques for a health laboratory - WHO
- National blood Policy 2061- Government of Nepal, Ministry of Health
- National blood Transfuion Policy 2071- Government of Nepal, Ministry of
- HealthLaboratory Practical Haematology -K. Parajuli

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	Total
Unit Hours	6	10	9	13	8	2	6	55	6	25	140
Marks	3	6	5	8	5	1	3	31	3	15	80

Hematology and Blood Banking (Practical)

Practical: 140hrs

- Perform the following tasks:
- Handling of various hematological equipment and apparatus.
- Collect blood sample for various hematological tests:
  - Capillary puncture (fingertip, ear lobe, toe and heel)
  - Venipuncture (using syringes and vacutainer)
- Prepare chemicals, reagents and solution and stain
  - Preparation of stains- Wright stain, Giemsa stain, Leishman's stain, Supra-vital stain.
  - Preparation of diluting fluid for WBC, RBC and platelets.
- Prepare thin and thick blood smears and stain by various method (Wright stain, Giemsa
- stain, Leishman stain)
- Identify normal and abnormal blood cells in stained blood smear.
- Perform Differential Leukocyte Count on blood smear.
- Perform
  - WBC count
  - RBC count
  - Platelet count
- Estimate haemoglobin by Sahli's and Cyanmethaemoglobin method.
- Perform ESR test by Wintrobe's and Westergren method.
- Perform Haematocrit (PCV) estimation: (Wintrobe method)
- Perform reticulocyte count.
- Demonstrate Sickling test, Hb electrophoresis.
- Perform following tests for blood coagulation disorders:
  - Bleeding Time (BT)
  - Clotting Time (CT)
  - Prothrombin Time (PT)
  - Activated PartialThromboplastin Time (APTT)
- Estimate blood cell indices values.
- Perform complete blood cell count using automated hematology analyzer
- Identify the blood parasites. (Plasmodium spp, Microfilaria)
- Perform ABO bloodgrouping and Rh typing
- Perform cross matching.
- Perform Coomb's test
- Prepare calibration curve for haemoglobin estimation by Cyanethemoglobin method.
- Manage waste from hematology lab