

## **Course Description of the Curriculum**

### **CLS 224: Basic Anatomy & Physiology**

To acquaint the student with a comprehensive knowledge about the anatomy and physiology of the human body that help him to build his background information in the basic sciences that will enable him to understand the deviation from the normal in the different specialties that he/she may be directed to later on

### **CLS 272: Histology**

The overall objective of this course is to prepare the students for the advanced courses in CLS and enables the student to identify microscopically the normal tissues and organs of the human body. This course will also cover the four basic tissues, their function, and the gross as well as the microscopic appearance of organs of the human body such as, nervous system, circulatory system, lymphatic system, respiratory system, digestive system, urinary system and the reproductive systems.

### **CLS 281: Basic Biochemistry and Biomolecules**

This course illustrates structures and functions of biomolecules which includes carbohydrates, proteins, lipids, nucleic acids, enzymes and hormones. In the practical part of this course, students study the detection and quantitative determination of some of these biomolecules.

### **CLS 251: Introduction to CLS and Biosafety**

This course will serve as an introduction to the principles of the CLS discipline & profession. Topics include a general look at the different academic disciplines within the lab sciences, the role by the medical technologist in healthcare, ethical conduct, professional organizations & licensure, & employment opportunities. Types of specimens submitted to the lab & proper collection & storage of each (with emphasis on phlebotomy), along with vacutainer tubes, their principle, and proper use. Test properties, establishment of reference ranges, and basic lab instruments (types of microscope, centrifuge, mixers, rotators and others), tools, and lab calculations are included. Safety measures taken in the lab are also emphasized.

### **CLS 261: Basic Microbiology**

This course provides the students with basic theoretical and practical aspects of various groups of microorganisms to include bacteriology, virology, mycology, and Parasitology as well as basic concepts of immunology and epidemiology. It also introduces the basic concepts of disinfectants,

antiseptics, preservatives, Ames test, methods of sterilization, aseptic techniques and general microbial control.

### **CLS 265: Basic Immunology**

This course is designed to give a basic understanding of theoretical and practical aspects of immunology. The first part of the course deals with the basic aspects of Immunology – Types of immunity, immune response, characterization of antigens, the humoral response ( different classes of antibodies ), the Complement system, the cellular response (different types of T cells and their functions, the cytokines), the immune regulation.

The second part of the course covers the Clinical aspects of immunology – Immunopathology, immunity to microbial infections, types of hypersensitivity reactions, auto-immune diseases, immunodeficiency diseases, transplantation, tissue typing and rejection.

### **CLS 275: General Pathology**

Upon completion of this course, the students will have the appropriate knowledge about the causes of cellular stress and the general pathologic responses to cellular stress, the circulatory disturbance, the basic immune reactions, the main immunopathologic processes, Disorders of growth and neoplasia.

### **CLS 282: Cellular Metabolism**

Course work involves a study of the metabolic activity of animal tissue and its regulation. Major catabolic pathways related to carbohydrate, amino acids, and fatty acids are discussed in detail. The study includes a look at the bioenergetics of cells as well as the digestion and absorption of food material.

### **CLS 291: Clinical Hematology**

This course teaches basic and diagnostic hematology with an emphasis on pathology. Normal hematopoiesis is covered in lecture, followed by a review of morphology of peripheral blood and bone marrow in lab and normal & abnormal hemoglobin.

### **CLS 361: Clinical Mycology**

In this course the students will learn about the fungi (molds and yeasts ) of medical importance and the diseases they cause. The classification, structure physiology, and cultural characteristics of fungi will be discussed. Emphasis in this course will be on the fungal diseases and their clinical presentation, pathogenesis, modes of transmission, laboratory diagnosis, prevention and control.

### **CLS 371: Pathophysiology & Molecular Pathology**

The pathophysiology part of this course teaches the students the cognitive skills needed for the evaluation of patient history and laboratory test results using case studies, recognition and correlation patterns of test results with specific disease processes, and how to prioritize confirmatory testing procedures and corresponding results. The molecular pathology part will introduce the student to the pathological changes at the molecular level related to the development and progression of disease especially cancer, and in assessing how these changes may be utilized as potential biomarkers or drug target.

### **CLS 381: Clinical Analytical Techniques**

The course deals with fundamental concepts of quantitative chemical analysis as well as the theoretical principles and operational protocols of instrumental techniques used in the clinical chemistry lab. The introductory part of the course involves molarity and pH calculations, a study of the mechanism of action and preparation of buffers and titrimetric type analysis. Instrumental analytical techniques and components are covered in detail and include Visible and UV spectrophotometry, atomic absorption, fluorescence, flame photometry, mass spectrometry, chemiluminescence, Osmometry and automated analytical systems. Separation methodologies including electrophoresis, different types of chromatography, ion selective electrodes and blood gas analyzers are also covered. In a separate part of the course basic concepts and operational procedures of electron microscopy is studied. Description of the components of both TEM and SEM as well as sample preparation and the development of micrographs are discussed.

### **CLS 391: Clinical Haematology-II**

This course teaches cell counting techniques; blood film staining and role of iron, vitamin B12 and folate. Anemias are covered through lectures, with morphology slides, and illustrative cases, which emphasizes to laboratory diagnosis. Normal hemostasis, coagulation disorders, and thrombotic disorders are presented through lectures, case discussions and laboratory unknowns.

Morphology slides and clinical correlations are used to present myeloproliferative - lymphoproliferative disorders and acute leukemia.

An individually assigned case study at the end of the course emphasizes proper evaluation of laboratory data, microscopic analysis, and differential diagnosis of common hematologic disorders.

### **CLS 351: Epidemiology & Emerging Diseases**

This course provides the principles and methods in the study of communicable and other diseases in space, overtime, and in populations. Factors related to their occurrence, case studies. The students will be exposed to basic concepts of epidemiology, applied mortality and morbidity in Saudi Arabia, and approaches to intervention in disease cycles (host, man and environment). The course finally offers an overview of both governmental and private disease control programs to combat communicable diseases, chronic diseases, and other illness, as well as population planning, accident prevention, and rehabilitation programs. Basic concepts of epidemiology, applied mortality and morbidity in Saudi Arabia. Approaches to intervention in disease cycle (Agent, host and environment).

### **CLS 377: Histology Techniques & EM**

This course will provide the student with the basic knowledge in the techniques of tissue preparation, staining and examination under the light microscope. Knowledge will be focused mainly on the paraffin technique; however, other histological methods will be covered. Also, the student will be instructed how to use the light microscope properly. An idea about the basic knowledge in the theory of magnification and resolution, knowledge about the structure of the electron microscope and its operation, techniques of tissue processing; preparation, and staining will be provided. Knowledge will be focused mainly on the avoidance of the artifacts. Students will be informed about some special techniques, scanning electron microscope and dark room.

### **CLS 362: Clinical Parasitology**

The course offers a description of the life cycles of clinically relevant protozoa and helminths, the ability to select and perform appropriate diagnostic techniques for the detection of single celled organisms, eggs, and mature helminths. For each parasite, topics of discussion will include classification, geographical distribution, life cycle, mode of transmission, pathogenesis, detailed laboratory diagnosis, and prevention and control.

### **CLS 363: Clinical Bacteriology-I**

The first part of this course deals with the theoretical and practical aspects of chemotherapeutic agents, their modes of action, and methods of evaluation, susceptibility testing and mechanisms of microbial resistance. The second part of the course describes the mechanisms of host parasite relationships, followed by a detailed study of the structure and physiology of Gram positive cocci

and Gram negative cocci, the aerobic spore and non-spore forming bacilli, and the Mycobacteria. The diseases caused by these organisms, the clinical presentation, pathogenesis, modes of transmission, laboratory diagnosis, antibiotic susceptibility testing, prevention and control will be fully discussed.

### **CLS 372: Cytopathology 2**

This course will provide the student with the basic knowledge of the theory and practical aspect in the diagnosis of tumour cells and non-malignant conditions. This can be achieved by microscopic examination of smears prepared from exfoliated cells or fine needle aspirated material. The course will enable the student to identify through the microscope, the normal and malignant cells by which malignant tumours can be diagnosed. The students also will be trained in the different technical methods applied in smears preparation and self precautions from contacting infections.

### **CLS 382: Clinical Biochemistry**

This is a required course in biochemistry for preparing a generalist in medical technology program. The course will provide a useful application of basic biochemistry along with physiological chemistry in developing an appreciation of the clinical significance of the tests, test methodology and interpretation of test results.

### **CLS 392: Haemostasis & Thrombosis**

This course covers the theoretical aspects of blood haemostasis and thrombosis in normal and disease states. Students will be engaged in comprehensive discussions related to the process of haemostasis with emphasis in the role of the vascular system, platelets, plasmatic coagulation as well as the process of fibrinolysis. The course will also cover the theory and lab evaluation of thrombophilia and thrombotic disorders. Diagnostic tests of haemorrhagic, coagulopathies and thrombotic disorders such as hemophilia, factor deficiency, hypercoagulability, and DIC are discussed in terms of relevance, principle of measurement, and result interpretation

### **CLS 354: Urinalysis & Body Fluids**

This is an interdisciplinary course that involves the formation, physiological importance, collection, transport, analysis, and interpretation of results obtained from non-blood body fluids. These include urine, CSF, serous fluid (transudates and exudates), synovial fluid, seminal fluid, amniotic fluid, gastric fluid, sputum, sweat, and stool. Fields of discussion cover physical

(macroscopic) properties in health and disease, chemical analysis, and microscopy. During practical lessons, students will gain experience in the field of body fluid analysis through hands-on learning strategies

### **CLS 353: Research Project-I**

The objective of this course is to give selected students an introduction of research on a limited small topic of their choosing and interest. They will learn the philosophy and tools of research such as how to review literature, how to write a research plan and protocol, and how to analyze, write up and present results of their study.

### **CLS 461: Clinical Virology**

This course deals with virus structures, morphology and classification. It also covers the physical, biochemical, and biological characters of viruses which include: virus-cell relationship (virus replication cycle), virus-host relationship (virus pathogenesis) and virus immunity. A general outline for laboratory isolation and identification of viruses in clinical specimens will be presented. The clinical presentation of some virus diseases, their pathogenesis, laboratory diagnosis, prevention and controls will also be discussed.

### **CLS 463: Clinical Bacteriology-II**

This course is a follow-up to CLS 363 and completes the Clinical Bacteriology courses. It deals with the study of structure and physiology of Gram-negative bacteria to include the tribes of Enterobacteriaceae, the species of the following genera or groups: Pseudomonads, Vibrio, Campylobacter, Helicobacter, Bordetella, Brucella, Haemophilus, Legionella and related organisms, Spirochaetes, the anaerobic bacteria, Mycoplasmas, Chlamydia. The diseases caused by these organisms, the clinical presentation, pathogenesis, modes of transmission, laboratory diagnosis, antibiotic susceptibility testing, prevention and control will be fully discussed.

### **CLS 465: Clinical Immunology and Serology**

The basic knowledge gained in basic immunology (CLS 215) course will be used as a basis for understanding how immune system disorders arise, and the clinical investigations of immunopathology. Emphasis will be on laboratory tests used to detect hypersensitivity, autoimmunity and autoimmune diseases, immunodeficiency, Tissue typing, and acute-phase

proteins, complement and cytokines. Practical aspects of the immunodiagnostic and serological procedures

#### **CLS 466: Infection Control & Prevention**

This course offers the students a comprehensive overview of healthcare-associated infection both locally and globally. Topics include definitions and global burden of nosocomial infections, in terms of costs, morbidity and mortality. Discussion will cover classification of hospital pathogens, infections acquired from medical devices and instruments, types of hospital items to include critical, semi-critical, and non-critical with respect to disinfectant classification (low, intermediate, and high level) with examples of each case. Types and detection of antimicrobial resistance both phenotypically and on the molecular level will also be discussed. The course describes airborne, water-and food-borne pathogens and their tracing methods. The course concludes with review prevention and control strategies of different infectious disease

#### **CLS 469: Molecular Diagnostics Techniques**

This course offers basic molecular biology techniques that are commonly used in molecular diagnostics. These include basic techniques such as nucleic acid and protein extraction, purification, and quantification that will serve as the basis for advanced methods employed in the clinical laboratory. The course also covers fundamental methods in molecular diagnostics which include PCR, RFLP, array-based technology, cytogenetics approaches, and western blot. Topics will also cover newly developing techniques such as next generation sequencing and MALDI-TOF and their applications in clinical laboratory for detection of diseases.

#### **CLS 491: Immunohaematology & Transfusion Medicine**

This course includes the introduction of the theory, practical application, technical performance and evaluation of blood bank procedures required for safe transfusion of blood and blood components. The students will be trained to perform patient specimen processing and pre-transfusion testing including blood ABO and Rh typing, antibody screening and antibody identification. The student will learn to select compatible blood types for each blood component and perform necessary pretransfusion compatibility testing for red blood cell transfusion. The course will include proper blood component processing, storage, and modifications of components such as thawing plasma or washing red blood cell units. Transfusion therapy practices, blood group system biochemistry, genetics, and serology are stressed. Also emphasized are various quality

assurance processes including daily quality control, including reagent quality control and error reporting as well as the investigation of suspected transfusion reactions. Case study presentation will lead the student through problem solving of incompatible reactions and situations they will likely encounter in a blood bank. Advanced techniques and current developments in stem cell transplant and cord blood banking will also be discussed.

#### **CLS 454: Lab Management & Quality Control**

Main purpose for this course by the end, the student will be able to learn to cope with these highly sophisticated technical and professional problems. The course is directed to toward the goal of competent performance in the laboratory supervisory position. Detailed instruction on Quality control monitoring and safety measures in clinical laboratories. In addition to the use of the computer programming in Bioinformatics and diagnostic lab tests analysis

#### **CLS 456: Research Project-II**

Through this course, we teaches the students writing skills at a professional level. It also gives them the ability to present lectures in a skillful manner and to assess the level of understanding of the given topic. Response to questions from instructors and students will also be assessed.

#### **CLS 467: Microbiology Clinical Practice**

This final microbiology course involves lectures as well as practical sessions in a hospital Microbiology laboratory. The lectures will deal mainly with specimens received in the bacteriology laboratory, their collection, suitability, and processing. The students will be introduced to the safety measures implemented in the laboratories. They will learn about culture media preparation and sterilization, processing of specimens, isolation/ identification of organisms, and antibiotic susceptibility testing. The diagnostic techniques in the routine Clinical Immunology, Mycology and Virology laboratories will also be taught.

#### **CLS 468: Immunology Clinical Practice**

This course involves lectures as well as practical sessions in the hospital which includes diagnostic techniques in the routine clinical immunology of different immunological disorders such as hypersensitivity, autoimmune diseases, Immunodeficiency as well as tissue rejection reactions and tumor markers using different immunological techniques such as flow cytometry techniques, fluorescence activated cell sorter (FACS), HLA typing and different allergic skin test. In addition to molecular diagnosis of immunological disorders.



### **CLS 478: Histopathology & Cytopathology Clinical Practice**

A comprehensive review of fundamental principles governing the work flow in the anatomic pathology laboratories in terms of hierarchical organization, staff roles, and laboratory management. Requirements of a fully functional histopathology and cytopathology laboratories will cover reagents, stains, and instruments. The course also includes hospital visits to both the histopathology and cytopathology laboratories.

### **CLS 488: Biochemistry Clinical Practice**

This course is designed to train students in routine procedures performed in a biochemistry laboratory. Laboratory part of the course will be done under the supervision of a trained technologist in a hospital laboratory. After completion of the course students should have a good knowledge of laboratory skills required for a clinical chemistry laboratory to include: overall organization, safety precautions, specimen handling and quality control procedures. They will be able to perform routine and special chemistry test in serum or urine using manual, semi-automated or automated equipment.

### **CLS 489: Clinical Endocrinology & Toxicology**

This course is divided into 3 sections: The first is endocrinology, and will highlight the physiology of the endocrine system, the chemical diversity of hormones, their modes of action, effects, and regulation. Pathology of the endocrine system and laboratory diagnosis of endocrine disorders will cover thyroid function tests and thyroid tumor markers, parathyroid glands, adrenal glands, fertility tests, pituitary insufficiency, adrenal genital syndrome, hypertension, and water and mineral balance. Topics will cover specimen, principles and techniques used in hormonal assays, and interpretation of endocrine tests in clinical settings. The second section is toxicology, which will cover toxic effects, signs and symptoms, metabolism and excretion of alcohols, heavy metals, analgesics, and drugs of abuse (Cocaine, Opiates, Amphetamine, Cannabis (Hashish), Barbiturate, Benzodiazepine, Alcohol, Antidepressants, and Phenylcyclidine (PCP), as well as laboratory assessment of forensic issues and the poisoned patient. The last section deals the pharmacokinetics, therapeutic and toxic states, metabolism, and excretion of commonly prescribed medications, namely aminoglycoside, cardioactive, anti-convulsants, anti-depressants,

immunosuppressants, and others. The focus is directed toward blood level monitoring and dose optimization.

### **CLS 498: Haematology & Immunohaematology Clinical Practice**

This clinical practice module aims to allow the students to gain applied experiences and technical competencies in the areas of haematology and blood bank. Clinical practicum in hospital laboratories designed to develop entry-level competencies and to assist the student in making the transition to clinical laboratory profession. Under the supervision of certified medical technologists, students will be trained to apply the routine diagnostic laboratory work in haematology lab starting from specimen collection right through to sending results to the clinicians. In the blood bank, the emphasis will be in practical application, technical performance and evaluation of immunohematology procedures required to provide compatible blood components for transfusion. In addition, the students will be encouraged to participate in the processing and production of blood products

### **CLS 457: Medical Genetics & Cytogenetic**

This course is designed to give a basic understanding of the theoretical and practical aspects of medical genetics and genetic disorders. Students will study a broad range of basic concepts, including the structure and function of the cells, DNA, RNA, proteins, cell cycle, central dogma, and their medical relevance. Then, description of relevant medical genetics topics the such as, Mendelian and complex trait inheritance, cytogenetics, population genetics and the study of genetic abnormalities such as mutagenesis leading to genetic disease disorders and carcinogenesis are covered. In addition, molecular diagnostic techniques such as nucleic acid mutation detection techniques, PCR, and emerging topics about population genetics, precision medicine and epigenetics are also taught.

### **CLS 455: Assisted Reproductive Technologies & Embryology**

Reproductive biology is the study of the fascinating process in which a single oocyte is fertilized and developed into a complete fetus of multi cells of different types and functions. The current course aims to provide knowledge on the scientific principles of reproduction in humans. This will be achieved through broad range of both conventional and recent topics in the field including reproductive anatomy, reproductive physiology and endocrinology, infertility, assisted reproductive techniques; clinical approach and recent advancements, pre-implantation genetic

screening, and fertility preservation in addition to a brief overview of embryonic stem cell biology and biotechnology. Advancements in the field have allowed more knowledge for assisted conception and revolutionised reproductive practice. The field of reproductive biology is multidisciplinary in which it integrates molecular biology, genetics, biochemistry, cell biology and cell signalling, anatomy, and physiology, allowing the student to link range of disciplines. Upon completion of the course, students should learn the significant impact of the reproductive biology on the understanding of modern reproductive medicine, human infertility, and treatment by utilising recent assisted reproductive technologies.