2 Theory = 2 credits	Radiation Biology	RAD 221
المتطلب السابق: **Human Anatomy and Physiology (1)** **HRS 112** **Introduction to Radiation Physics** **RAD 211**	This course covers the interactions of radiation with cells, tissues and the body as a whole. It also covers the resultant biophysical events, the theories and principles of radiosensitivity and response and the biological principles of radiation therapy At the end of the course, the student should be able to: Explain the principles of radiation biology and compare these with the principles of cellular biology. Distinguish between units of radiation quantities and radiobiological measures and demonstrate correct usage. Compare and contrast somatic and genetic effects of radiation. Describe radiolysis of water related to target theory and radiation-induced intracellular chemical reactions. Apply the principles of radiobiology to tumor cell biology and evaluate radiation effects anticipated in the clinical practice of radiation therapy. Explain the relationship of time, dose, fractionation, volume and site and radiation effects. Explain and interpret factors affecting RBE, cell cycle and cell death. Categorize the systemic responses to radiation with respect to varying tolerance of differing organs and systems including hematological system and skin. Describe in detail the 4R's of radiobiology and the concept of LD 50/30.	

2 Theory + 1 practical = 3 credits	Computed Tomography	RAD 222
المتطلب السابق: **Introduction Radiological Modalities** **RAD 212** **Introduction to Radiation Physics** **RAD 211**	This course introduces CT instrumentation and operation, components- the x-ray system, detectors and computer, scanning, image processing and display, scanning parameters and their effects– kVp, mA, time, table speed, beam width and reconstructed slice width, filtrations and their effect, CT image quality - contrast sensitivity, high and low contrast resolution, noise and artifact, basic imaging techniques and principles, radiation safety for patient and operator, image optimization. Summary of the main learning outcomes for students enrolled in the course. - Understanding of evolution of computed tomography - Physical principles and instrumentation involved in computed tomography - Physic topics; the characteristics of x-radiation, CT beam attenuation, linear attenuation coefficients - Tissue characteristics and Hounsfield attenuation numbers application, data acquisition and manipulation, image reconstruction algorithms, such as filtered back-projection and transform - Components of C T scanner; Gantry assembly (patient aperture, rotating frame, x-ray tube, collimator, and detectors), Patient table, Operator console, CT computer and Workstations - Operation of Scan console and Display console to demonstrate various functions.	

2 Theory = 2 credits	Pathology	RAD 223
المتطلب السابق: **Human Anatomy and Physiology (1)** **HRS 112**	The course is designed to provide the students with extensive knowledge about disease processes in relation to etiology, and the pathophysiology disorders that compromise healthy systems, with emphasis on radiographic manifestations, procedural and technical considerations as well as advantages and disadvantages of various imaging modalities Describe the various pathologic conditions affecting each body system including, etiology pathogenesis, manifestations, complications and prognosis. Define basic terms related to pathology. Summarize the process of tissue disruption, repair, and healing. Categorize specific diseases into systemic classifications	

2 Theory + 1 Practical = 3 credits	Introduction to Radiation Physics	RAD 211
المتطلب السابق: **Biology for Health programs** **HFSB 101–1**	This course introduces the structure of atom and radiation – concept, nature nd production. Topics include electromagnetic spectrum, radioactivity and half-life, x-ray production – characteristics and the interaction of radiation with matter, dosimetry, radiation safty Summary of the main learning outcomes for students enrolled in the course. Radiations principles, behaviours, and interactions. The atom structure, binding energy, excitation, ionization and non-ionization and atomic radiation. Radioactivity decay law and half-life. Radiation interaction with matter.	

2 Theory = 2 credits	**Introduction Radiological Modalities**	**RAD 212**
المتطلب السابق: **Biology for Health programs** **HFSB 101–1**	This course is an overview of the diagnostic and therapeutic radiological modalities. Emphasis will be on general operating principles of the modality and its integration into patient diagnosis imaging and radiation therapy. Modalities to be covered are X-ray, CT, MRI, US, Gamma camera, and PET Summary of the main learning outcomes for students enrolled in the course. - Diagnostic and therapeutic radiological modalities within the health care and health industrial framework - Uses purpose of diagnostic imaging and radiation therapy modalities - Impacts assessment of each modality on treatment and diagnosis Managements	

2 Theory + 1 practical = 3 credits	Human Anatomy and Physiology (2)	HRS 113
المتطلب السابق: Human Anatomy and Physiology (1) HRS 112	By the end of the course, the student will be expected to be able identifiy and understand the followinh Respiratory system Digestive System Endocrine System Cardiovascular system Body Fluid & Blood Urinary system Reproductive System Lymphatic and immunity system Integumentary system Nervous system	

2 Theory + 1 practical = 3 credits	Emergency life support techniques	HRS 114
المتطلب السابق: Human Biology HFSB 101–1 Biology for Health programs HFSB 102–1	The course is a 3 unit course of lectures and laboratory which develops the students knowledge on the basic concepts first aid and cardiorispiratory resuscitation. The student will also be learning how to assess emergency situations such as bleeding, fractures , wounds and shock. The student will also be learning how to prevent disease transmition, and isolation concepts. To realize the general concepts and the basis of first aid and perform CPR effectively To deal with and manage common first aid emergencies. To deal with and manage common first aid emergencies. To assess the emergency situation and categorize the patients according to the periorities and degree of illness To communicate with the operator , colleagues and patients relatives effectively based on professional ethics and control protocols	

3 Theory = 3 credits	**Society and Health**	**HRS 115**
المتطلب السابق: **لايوجد**	This course deals with various determinants of health, recent trends in population health, biological, social, political, ethical and psychological dimensions of health and illness as well as health status differences among different communities or cultures. This course also deals with the causal model of the determinants of disease, health function and well being − Recognize how the community affects health − List various determinants of health − Explain recent trends in population health − Compare biological, social, political, ethical and psychological dimensions of health and illness − Explain health status differences among different communities or cultures Illustrate causal model of the determinants of disease, health function and well being	

2 Theory + 1 practical = 3 credits	**Biostatistics**	**HRS 116**
المتطلب السابق: **Human Biology** **HFSB 101–1**	After the introductory course "Introduction to biostatistics".The goal of this course is to learn advanced techniques in data analysis for quantitative and cathegorical variables. In this course, students will perform inference about means, correlation, regression and inference about proportion, using hand calculations and computational support (SPSS) Multiple linear regression Students will learn inference about mean Inference about a proportion Comparing independent means Comparing two proportions Comparing several means –ANOVA- Cross tabulated counts Correlation Stratified 2 by 2 tables Regression Multiple linear regression	

2 Theory + 1 practical = 2 credits	Health administration and informatics	HRS 117
المتطلب السابق: لا يوجد	This course provides the students with basic knowledge and skills pertaining to the current issues in Health administration and informatics. Topics include healthcare, health organizations, management, planning, organizing, leadership, controlling and improving performance, making decisions and solving problems, management information systems as well as improving services with informatics tools − Define management, leadership, planning and health information − List various health systems prototypes − Recognize reasons, structures and processes of groups and teams − Recognize leadership theories, traits, skills and behaviors − Recognize record linkage and data protection − Differentiating management and leadership − Compare methods for making decisions − Discuss barriers to effective decision making − Assess quality of health information Coordinate jobs and positions in a healthcare organization	

2 Theory + 1 Practical = 3 credits	**Human Anatomy and Physiology (1)**	**HRS 112**
المتطلب السابق: **Biology for Health programs** **HFSB 101–1** **Human Biology for Health programs** **HFSB 102–1**	Summary of the main learning outcomes for students enrolled in the course. Identify the location of anatomical structures using directional and orientation terms. Describe and identify the anatomical parts of skeletal system and joints on radiographs. Demonstrate the use of topographical landmarks to locate internal structures Acquire knowledge of the functions of the skeletal, joint and muscle systems . Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field) Regularly solicits feedback from students. Describe the structure and function of a human cell. Discuss tissue types and describe the functions of each type. Define radiographic anatomical terminologies. Describe the anatomic position. Classification of bones according to shape . Describe the basic anatomical structure of bone, bone development and growth.	

1 Theory + 1 Practical = 2 credits	Image interpretation	RUS 416
المتطلب السابق: **Sonography cross–sectional Anatomy** **RUS 315**	Interpretation of diagnostic imaging examinations is a key skill for many healthcare practitioners and has a significant impact on service delivery. This course will provide the student with image interpretation skills and knowledge of the radiological and clinical indicators which are utilised to identify pathology of the axial skeleton and abdomen. The unit aims at enabling the practitioner to achieve a level of competency sufficient to participate. The course is designed to cover normal anatomy and normal variants common fractures, including their prevalence and mechanism of injury subtle injuries that are often missed radiologically but which are clinically significant soft tissue signs in the absence of obvious bony injury fracture classification including common eponyms risk factors, including potential pathological conditions, which may either predispose to the injury or be an incidental finding other associated injuries following initial diagnosis radiographic projections to aid the non-radiographer in diagnosis	

2 Theory = 2 credits	Special Topics in Sonography	RUS 421
المتطلب السابق: **Abdominal Sonography& Procedures** **RUS 222** **Pelvic Sonography& Procedures** **RUS 314** **Vascular Sonography& Procedures** **RUS 321**	In this course presents new techniques and information, clinical experiences and presentation of case studies in a weekly seminar format. This includes an overview of sonographic contrast agents, pediatric hips, three- and four-dimensional sonography, and new advances in ultrasound technology. • Presents new techniques and information • Have good clinical experiences • Able to do presentation of case studies in a weekly seminar format. Understand and have good overview of sonographic contrast agents, pediatric hips, three- and four-dimensional sonography, and new advances in ultrasound technology.	

2 Theory = 2 credits	**Research Project (2)**	**RUS 422**
المتطلب السابق: **Research Project (1)** **RUS 411**	In this course students select an aspect of sonography of particular interest and prepare a paper on this topic. They will perform a literature review and find peer reviewed articles which are relevant to the project. They will prepare a written paper using standardized formatting. The project will be presented to the class at the end of the course. It is a goal of this course that students will submit their project to the Journal of Diagnostic Medical Sonography for consideration for publication. This is an individual project. Plagiarism is not acceptable. • Integrate knowledge gained through the academic and clinical portions of the program to prepare a paper that is relevant and timely. • Correctly manage issues of patient confidentiality. • Perform a literature review. • Prepare a paper using a standardized format. Present a paper to the class demonstrating effective use of audio and visual tools.	

1 Theory + 1 Clinical = 2 credits	Instrumentation and Quality Control	RUS 423
المتطلب السابق: **Ultrasound Physics (1)** **RUS 221** **Ultrasound Physics (2)** **RUS 313**	This is a course which combines theory and practice in ultrasound instrumentation and quality control. Topics include functions of the components of processing, scan converter displays, image and display techniques, film and methods of permanent image recording, ultrasound transducers, operating standards, equipment calibration, resolution, gray scale photography and film critique. • Understand the Ultrasound quality control test procedures, preventive maintenance, equipment calibration, in-service education of sonographers, Ultrasound machine specification, acceptance testing of new equipment, and evaluation of new products. Describe routine ultrasound QC tests to be performed by or under the supervision of a medical physicist.	

1 Theory + 1 Clinical = 2 credits	**High resolution & Small Parts Sonography**	**RUS 424**
المتطلب السابق: **لا يوجد**	This course integrates relational anatomy, cross sectional anatomy and physiology with sonographic principles in the imaging of the normal and abnormal male pelvis, breast, neck, musculoskeletal, neonatal and pediatric. Scanning the normal and abnormal gastrointestinal tract, scrotum and salivary glands are introduced as well. Advanced imaging techniques and critical thinking skills are developed through correlation of clinical history with sonographic areas of interest and findings. • Describe the normal sonographic appearance of the gastrointestinal tract, scrotum and salivary glands. • Describe the sonographic principles in measuring the scrotum and portal vein. • Differentiate normal from focal or diffuse pathological processes when imaging the abdomen, male pelvis, neck and scrotum as assessed with sonography. • Differentiate normal anatomy from pathological processes when imaging the neonate and pediatric head and abdomen. • Evaluate normal and abnormal Doppler findings when assessing the scrotum and thyroid. • Compare and contrast the role of sonography with other imaging modalities in the detection of complex pathology. • Recognize and describe the sonographic appearance of normal muscles, nerves and tendons when assessing superficial tissues of the extremities. • Identify and describe uncomplicated musculoskeletal pathology including complete tendon tears, intramuscular hematomas and joint effusions. • Recognize and describe the sonographic appearance of superficial masses, foreign bodies and hernias. • Describe the role of a Sonographer during fine needle aspiration or core biopsy. • Describe the potential complications of biopsies or interventional procedures, such as hematomas, pseudoaneurysms and arteriovenous fistulas. • Describe the potential uses for emerging technologies in the field of Sonography. Describe the normal sonographic appearance of the thyroid and scrotum	

1 Theory + 2 Clinical = 3 credits	**Clinical Practicum (5)**	**RUS 425**
المتطلب السابق: **Clinical Practicum (4)** **RUS 414**	This course integrates relational anatomy, cross sectional anatomy and physiology with sonographic principles in the imaging of the normal and abnormal male pelvis, breast, neck, musculoskeletal, neonatal and pediatric. Scanning the normal and abnormal gastrointestinal tract, scrotum and salivary glands are introduced as well. Advanced imaging techniques and critical thinking skills are developed through correlation of clinical history with sonographic areas of interest and findings. • Describe the normal sonographic appearance of the gastrointestinal tract, scrotum and salivary glands. • Describe the sonographic principles in measuring the scrotum and portal vein. • Differentiate normal from focal or diffuse pathological processes when imaging the abdomen, male pelvis, neck and scrotum as assessed with sonography. • Differentiate normal anatomy from pathological processes when imaging the neonate and pediatric head and abdomen. • Evaluate normal and abnormal Doppler findings when assessing the scrotum and thyroid. • Compare and contrast the role of sonography with other imaging modalities in the detection of complex pathology. • Recognize and describe the sonographic appearance of normal muscles, nerves and tendons when assessing superficial tissues of the extremities. • Identify and describe uncomplicated musculoskeletal pathology including complete tendon tears, intramuscular hematomas and joint effusions. • Recognize and describe the sonographic appearance of superficial masses, foreign bodies and hernias. • Describe the role of a Sonographer during fine needle aspiration or core biopsy. • Describe the potential complications of biopsies or interventional procedures, such as hematomas, pseudoaneurysms and arteriovenous fistulas. • Describe the potential uses for emerging technologies in the field of Sonography. Describe the normal sonographic appearance of the thyroid and scrotum	

2 Theory + 1 Practical = 3 credits	Radiation Biology	RUS 221
المتطلب السابق: **Introduction to Radiation Physics** **RAD 211**	Ultrasound physics I is an introductory course that presents the basic physical principles that apply to diagnostic ultrasound imaging. The course will review some mathematical tools (i.e. basic algebra, logarithms, and trigonometry), describe the properties of waves and relate these properties to sound and ultrasound. The physical principles of ultrasound creation and detection will be described along with the basic instrumentation used in single element and multi-element transducers. The pulse-echo imaging technique will be covered and real time imaging modalities will be explained. Digital imaging and storage will be reviewed along with an overview of the Picture Archiving and Communication system (PACS) in relation to the Radiological Information System (RIS). Finally, a brief introduction to Colour Doppler imaging will be given. The emphasis of this course will be in the integration of concepts with applications. • Effectively communicate and interpret diagnostic sonographic measurements using proper units and prefixes, and to perform unit conversions. • Describe the basic properties of ultrasound waves including their wavelength, period, and frequency, the nature of wave propagation, wave reflection and refraction, amplitude and intensity measurement, and beam attenuation. • List the types of ultrasonic transducers commonly used in diagnostic sonography, report their internal construction, and compare and contrast the beam characteristics of each type. • Explain the pulse-echo technique used to form sonographic images and the limitations the techniques impose on resolution and frame rates. • Describe digital image processing, storage, and display techniques commonly used in sonography. Outline the advantage and disadvantages of the Picture Archiving and Storage system (PACS) used for image storage, manipulation, and sharing. State the different types of imaging modalities available to diagnostic sonography, including A-mode, B-mode, M-mode, and Doppler Imaging (Colour Doppler, Pulsed Wave or Spectral Doppler, and Power Doppler).	

2 Theory + 1 Practical = 3 credits	Abdominal Sonography& Procedures	RUS 222
المتطلب السابق: **Introduction to Radiation Physics** **RAD 211** **Introduction to Radiological Modalities** **RAD 212**	This course integrates relational anatomy, cross sectional anatomy and physiology with sonographic principles in the imaging of the normal and abnormal abdomen, male pelvis and gastrointestinal tract. Common pathologies or anatomic variants that students are likely to encounter in their first practicum are introduced. Critical thinking skills are developed through the correlation of sonographic findings with clinical history and alternate imaging modalities. Theory taught in this course will be integrated with laboratory experience through both live and simulated practice. Describe scanning protocols and patient preparation for abdominal and male pelvic sonograms. Identify normal sonographic relational or sectional anatomy in the abdomen and male pelvis. Evaluate ultrasound images using sonographic terminology and criteria. Differentiate between intraperitoneal and retroperitoneal spaces on sonograms. Describe the normal sonographic appearance of the abdominal wall, adrenal glands, aorta and common iliac arteries, biliary tract, inferior vena cava, liver, male pelvis, pancreas, kidneys and urinary tract, renal vasculature and spleen. Describe the sonographic principles in measuring the biliary tract, liver, pancreas, pancreatic duct, spleen, kidneys, prostate, urinary bladder, aorta and common iliac arteries. Differentiate normal findings from anatomic variants or artefacts. Describe the sonographic features of more complex disease pathways, such as the potential relationships between hepatitis, cirrhosis, portal hypertension and hepatocellular carcinoma. Evaluate normal and abnormal abdominal Doppler findings when assessing the liver, kidneys, pancreas and spleen. Correlate changes in abdominopelvic organs or structures with patient aging and size. Differentiate normal anatomy from abnormal greyscale and	

	Doppler findings when assessing shunts, grafts or transplants. Correlate laboratory tests, clinical symptoms and patient history with sonographic findings. Correlate clinical, laboratory and imaging data in preparation for a biopsy, contrast, endorectal or interventional procedure. Differentiate the sonographic appearance of normal abdominal structures from congenital malformation, focal pathology or anomalous conditions. Differentiate the sonographic features of a simple or complex cyst from a solid mass. Describe the sonographic principles in measuring or documenting focal pathology, enlargement, thickening or dilation. Recognize and describe the sonographic appearance of a solid or cystic mass as seen within, or arising from the pancreas, liver, kidney, urinary tract, adrenal gland or spleen. Recognize and describe the sonographic appearance of focal aortic, caval and biliary pathology or conditions. Compare and contrast the role of sonography with other imaging modalities in the detection of focal abdominal pathology. Identify situations where the sonographic examination needs to be extended or modified, in order to obtain additional diagnostic information**.**

1 Theory + 2 Clinical = 3 credits	**Clinical Practicum (1)**	**RUS 311**
المتطلب السابق: **Abdominal Sonography& Procedures** **RUS 222** **Ultrasound Physics (1)** **RUS 221**	Clinical Practicum I (Abdomen) is the first clinical course in the program. Students in this course gain hands on experience in the settings of abdomen; may include on-campus laboratories, private office setting, as well as hospital rotations. Students who successfully complete this course will be able to satisfactorily perform portions of normal, uncomplicated studies with minimal assistance as defined in the Clinical Manual and individual clinical target summaries. Effective communication with patients and staff and safe practice are emphasized through all clinical courses in this program. • Interact with patients and their families and clinical staff in a professional manner. • Demonstrate effective and appropriate communication with patients, their families, and staff in the clinical environment. • Demonstrate strong initiative, time management, organization and team skills. • Provide required patient care (safety, washroom, oxygen, intravenous, infection control, transfer, trust). • Assess and monitor patient condition. • Demonstrate efficient, effective use of scanner controls to optimize image quality. • Obtain images of normal and abnormal structures with landmarks. • Recognize abnormal findings and document abnormalities. • Integrate knowledge of anatomy, physiology and pathology into sonographic examinations. • Assist in all aspects of interventional procedures (biopsies, drainages, etc.) using sterile technique. • Correlate clinical history and other diagnostic testing with sonographic findings. • Perform technically satisfactory and complete sonographic examinations efficiently. • Customize examination procedures according to findings or patient status. • Answer the clinical question in each patient situation. • Demonstrate independent judgment and problem solving skills. • Extend the examination as necessary to include imaging of additional structures and interrogation with Doppler. • Communicate the findings both in writing and verbally. Demonstrate safe ergonomic practices.	

2 Theory + 1 Practical = 3 credits	Obstetrical Sonography& Procedures	RUS 312
المتطلب السابق: **Ultrasound Physics (1)** **RUS 221**	This course covers first, second and third trimester pregnancy as assessed with sonography. Normal maternal and fetal anatomy are discussed, along with some common abnormalities that students may encounter in their first practicum. Color and pulsed wave Doppler are introduced for the assessment of blood flow hemodynamics. This course also emphasis on more complex pathology and pathophysiology of the female pelvis and all stages of pregnancy as assessed with sonography. Examples of complex conditions include maternal disease as it affects the fetus and complications of multiple pregnancy. Critical thinking skills are developed through correlation of clinical history with sonographic areas of interest and findings. Discuss the indications for second and third trimester sonograms. Discuss how to take patient history for second and third trimester sonograms. Identify normal intrauterine and extrauterine anatomy on second and third trimester sonograms. Describe sonographic techniques used to image specific fetal and maternal structures in the second and third trimester. Describe measurement techniques to assess fetal age, growth, cervical length and amniotic fluid. Discuss multiple gestation and related scanning protocol. Describe etiology, clinical features and patient characteristics of pathologies and conditions covered in this course. Describe the sonographic features of discussed pathologies and conditions including: Uterus, cervix, vagina, fallopian tubes and ovaries. Maternal uterus and adnexa, gestational sac and yolk sac. Placenta, umbilical cord, membranes and amniotic fluid. Fetal cranium, brain, spine, face, neck, abdomen, pelvis and skeleton. Fetal syndromes and disorders. Recognize the sonographic appearance of anomalous and pathologic conditions on pelvic and obstetrical sonographic images. Correlate patient history, laboratory findings and symptoms with sonographic findings and maternal disorders. Describe imaging and measurement techniques used to assess and document anomalous and pathologic conditions on sonograms. Identify situations where an examination must be extended to obtain additional qualitative and quantitative information to aid the sonologist interpreting the examination. Identify features of technically good 2D, m-mode and Doppler images. Describe techniques for image optimization. Differentiate pathology from imaging artifacts, normal structures and variants of normal. Describe etiology, clinical features and patient characteristics of pathologies and conditions covered in this course. Describe the sonographic features of discussed pathologies and conditions	

2 Theory + 1 Practical = 3 credits	**Ultrasound Physics (2)**	**RUS 313**
المتطلب السابق: **Ultrasound Physics (1)** **RUS 221**	This course builds upon the concepts presented in the first level RUS 221 Ultrasound Physics I course. The main focus will be on Doppler imaging for diagnostic sonography, describing the underlying physics and instrumentation for the different Doppler imaging modes (Continuous Wave Doppler, Pulsed Wave Doppler, Colour, Power and tissue Doppler). In addition, the biological effects of ultrasound and ultrasound safety will be presented. The course is specific to Sonography with an emphasis on conceptual understanding of the physical phenomena. • State the Doppler effect, its application to diagnostic sonography, and the variables which affect the velocity reading. • Compare and contrast the differences between the different Doppler imaging techniques (CW Doppler, PW Doppler, Colour Doppler, Power and tissue Doppler), including their advantages and disadvantages. • Describe the Nyquist limit and its relationship to aliasing of the Doppler signal. • State the main biological effects of ultrasound imaging, namely thermal heating and cavitation and describe how these effects depend on the frequency of the ultrasound pulses used. • Define and explain the significance of the various bio-effect indices (SATA, SATP, SPTA, SPTP) and the output display standards, TI (thermal index) and MI (mechanical index). • Understand the AIUM and Health Canada statements on bioeffects and safety for diagnostic medical sonography. Use these guidelines to help implement ALARA.	

2 Theory + 1 Practical = 3 credits	Pelvic Sonography& Procedures	RUS 314
المتطلب السابق: **Ultrasound Physics (1)** **RUS 221**	Pelvic Sonography integrates embryology, relational and cross sectional anatomy and physiology with sonographic principles in imaging of the normal and complex pathology and pathophysiology of the female pelvis. Common pathologies and variants that students are likely to encounter in their first clinical are introduced. Theory taught in this course will be integrated with laboratory experience through both live and simulated practice. Describe normal female pelvic anatomy, including anatomic relationships. Identify normal pelvic anatomy on transvesicular and endovaginal sonograms. Describe the sonographic principles of real-time assessment of the female pelvis using transvesicular and endovaginal techniques. Describe the principles of 2D measurement of the ovaries, uterus and endometrium. Correlate sonographic findings with the physiology of the menstrual cycle. Identify normal organ variants and age related changes on pelvic sonograms. Correlate embryonic development with sonographic findings. Describe measurement techniques for determination of gestational age in the first trimester of pregnancy: Gestational sac size, crown rump length. Identify normal anatomy within the maternal pelvis on first trimester sonograms including: Maternal uterus, cervix, ovaries and embryonic membranes, gestational and yolk sacs. Describe scanning protocols for gynaecologic and first trimester sonograms. Explain the rationale for various patient preparations for pelvic, endovaginal and first trimester sonograms. Explain how to take patient history for pelvic and obstetrical sonograms. Describe the unique patient care aspects of gynaecologic and obstetrical sonography. Explain the indications and contraindications for endovaginal sonography.	

2 Theory + 1 Practical = 3 credits	Sonography cross–sectional Anatomy	RUS 315
المتطلب السابق: **Human Anatomy and Physiology (1)** **HRS 112** **Human Anatomy and Physiology (2)** **HRS 113**	This course introduces students to anatomy and physiology relevant to sonographers in the imaging of the abdominal and pelvic cavities. The focus of the course is on relational and cross sectional anatomy in the brain, abdominal / pelvic cavities and abdominal wall. Sectional human anatomy in the transverse, sagittal and coronal planes. Abdominal organs associated with the gastrointestinal tract such as liver, gallbladder and pancreas are emphasized. In addition, structure and function of the spleen, kidneys, adrenal glands and the blood vessels supplying the region is included in the course. Describe surface features of the brain, neck, abdomen, pelvis and selected musculoskeletal features of the abdominal wall. Describe detailed relational and cross-sectional anatomy of the structures contained within the brain, neck, abdomen, musculoskeletal and pelvis cavity. Describe the normal functions of the brain, neck, abdomen musculoskeletal and pelvis organs of particular interest to sonographers. Explain the normal anatomic and physiologic interactions between organs of the abdominal cavity and other organ systems. Correlate the functioning of abdominal organs with that of the cardiovascular system. Correlate normal functions of abdominal organs with chemical and physiological tests used to assess their functions. Apply an understanding of normal anatomy and physiology in a clinical setting.	

3Theory + 1 Practical = 4 credits	Vascular Sonography& Procedures	RUS 321
المتطلب السابق: **Ultrasound Physics (1** **RUS 221** **Ultrasound Physics (2)** **RUS 313**	Vascular Sonography introduces students to imaging of the carotid arteries and lower extremity veins. The course begins with anatomy and blood flow hemodynamics then shifts to sonographic applications. The focus in this course is on normal patterns as obtained with 2 dimensional and color / pulsed wave Doppler assessment of the carotid arteries and lower extremity veins. Integration of sonographic appearances with hemodynamics and physical principles is emphasized. It also emphasis on abnormal findings in the carotid arteries and extremity veins through the integration of clinical signs and symptoms, sonographic findings and hemodynamic consequences of vascular disease. Peripheral arterial Doppler and vascular grafts are introducede. Identify normal anatomy of the carotid arteries and lower extremity veins as visualized by ultrasound. Describe normal blood flow hemodynamics in arteries and veins. Correlate blood flow patterns with hemodynamics. Describe techniques to optimize 2D and Doppler data. Describe protocols for carotid and leg vein (DVT) sonograms. Analyse numeric velocity data to differentiate normal from abnormal carotid artery flow states. Articulate the criteria for normal when assessing extremity veins. Identify patient risk factors for vascular disease. Correlate patient clinical signs and symptoms with the presence and location of vascular disease. Describe sonographic features of arterial and venous disease. Correlate abnormal Doppler patterns in the carotid arteries and extremity veins with altered hemodynamics. Differentiate deep venous from superficial venous disease. Differentiate normal from abnormal sonographic findings. Analyze data to determine severity of disease. Identify the clinical and sonographic features of peripheral arterial disease. Identify types of arterial, venous and dialysis grafts. Describe the principles of peripheral arterial testing (i.e. ankle brachial index).	

3Theory + 1 Practical = 4 credits	Clinical Practicum (2)	RUS 322
المتطلب السابق: Clinical Practicum (1) RUS 311 Pelvic Sonography& Procedures RUS 314	Clinical Practicum II (OB & GYN)) is the second clinical course in the program. Students in this course gain hands on experience in the settings of the female pelvis; may include on-campus laboratories, private office setting, as well as hospital rotations. Students who successfully complete this course will be able to satisfactorily perform portions of normal, uncomplicated studies with minimal assistance as defined in the Clinical Manual and individual clinical target summaries. Effective communication with patients and staff and safe practice are emphasized through all clinical courses in this program Interact with patients and their families and clinical staff in a professional manner. Demonstrate effective and appropriate communication with patients, their families, and staff in the clinical environment. Demonstrate strong initiative, time management, organization and team skills. Provide required patient care (safety, washroom, oxygen, intravenous, infection control, transfer, trust). Assess and monitor patient condition. Demonstrate efficient, effective use of scanner controls to optimize image quality. Obtain images of normal and abnormal structures with landmarks. Recognize abnormal findings and document abnormalities. Integrate knowledge of anatomy, physiology and pathology into sonographic examinations. Assist in all aspects of interventional procedures (biopsies, drainages, etc.) using sterile technique. Correlate clinical history and other diagnostic testing with sonographic findings. Perform technically satisfactory and complete sonographic examinations efficiently. Customize examination procedures according to findings or patient status. Answer the clinical question in each patient situation. Demonstrate independent judgment and problem solving skills. Extend the examination as necessary to include imaging of additional structures and interrogation with Doppler. Communicate the findings both in writing and verbally. Demonstrate safe ergonomic practices.	

2 Practical = 2 credits	**Clinical Practicum (3)**	**RUS 323**
المتطلب السابق: **Clinical Practicum (1)** **RUS 311**	Clinical Practicum III (Vascular) is the third clinical course in the program. Students in this course gain hands on experience in the settings of vascular; may include on-campus laboratories, private office setting, as well as hospital rotations. Students who successfully complete this course will be able to satisfactorily perform portions of normal, uncomplicated studies with minimal assistance as defined in the Clinical Manual and individual clinical target summaries. Effective communication with patients and staff and safe practice are emphasized through all clinical courses in this program. • Interact with patients and their families and clinical staff in a professional manner. • Demonstrate effective and appropriate communication with patients, their families, and staff in the clinical environment. • Demonstrate strong initiative, time management, organization and team skills. • Provide required patient care (safety, washroom, oxygen, intravenous, infection control, transfer, trust). • Assess and monitor patient condition. • Demonstrate efficient, effective use of scanner controls to optimize image quality. • Obtain images of normal and abnormal structures with landmarks. • Recognize abnormal findings and document abnormalities. • Integrate knowledge of anatomy, physiology and pathology into sonographic examinations. • Assist in all aspects of interventional procedures (biopsies, drainages, etc.) using sterile technique. • Correlate clinical history and other diagnostic testing with sonographic findings. • Perform technically satisfactory and complete sonographic examinations efficiently. • Customize examination procedures according to findings or patient status. • Answer the clinical question in each patient situation. • Demonstrate independent judgment and problem solving skills. • Extend the examination as necessary to include imaging of additional structures and interrogation with Doppler. • Communicate the findings both in writing and verbally. Demonstrate safe ergonomic practices.	

1 Practica+ 1 Theory 2 credits	Vascular Hemodynamics & Physics	RUS 324
المتطلب السابق: **Human Anatomy and Physiology (1)** **HRS 112** **Human Anatomy and Physiology (2)** **HRS 113**	The main focus will be on hemodynamics and Doppler imaging for diagnostic sonography, describing the underlying physics and instrumentation for the different Doppler imaging modes (Continuous Wave Doppler, Pulsed Wave Doppler, Colour, Power and tissue Doppler). In addition, the biological effects of ultrasound, and ultrasound safety will be presented. The course is specific to Sonography with an emphasis on conceptual understanding of the physical phenomena. • Define basic fluid properties such as pressure, volume flow rate, and density, and will be able to convert between different units commonly encountered in medical technology. • Predict the relationship between vessel diameter and average flow speed from the equation of continuity. • Apply Bernoulli's law to predict pressure differences between 2 points in a flow that have different flow speeds. • Use Poiseuille's law for viscous laminar flow to define resistance to flow and to describe the flow characteristics that help to distinguish between normal and abnormal flow. • List the quality assurance and maintenance responsibilities of the Diagnostic Sonographer and describe the types of quality assurance tests that can routinely be implemented. State the physical principles behind Tissue Harmonic Imaging, Contrast Imaging, and Elasticity Imaging. Finally, the sonographer will be able to list the advantages and disadvantages of each of these imaging techniques.	

1 clinical+ 1 Theory 2 credits	**Patient care (Skills for sonographers)**	**RUS 325**
المتطلب السابق: **لا يوجد**	This course is an introduction in patient care skills applied to the role os a Sonographer in an imaging department. The goal of this course is to provide the student with the knowledge and skills to provide patient care in diagnostic ultrasound departments in hospital and health care clinics. The course introduces the student to the hospital environment and basic safety concepts of providing patient care Professionalism and professional communication skills will also be explored. Demonstrate professional interaction with other student patients. Demonstrate effective verbal and nonverbal communication with other students and staff in the laboratory setting. Demonstrate initiative, organization and team skills. Demonstrate patient care as appropriate to the laboratory setting. Demonstrate effective use of required scanner controls. Perform normal abdominal and gynecological sonograms. Obtain high quality images. Evaluate images for quality and content. Integrate knowledge of normal anatomy and physiology into sonographic examinations. Describe 3D relationships of structures. Demonstrate thorough and effective scanning technique. Demonstrate effective hand eye coordination. Demonstrate safe ergonomic practices. Demonstrate effective use of all scanner controls. Demonstrate effective hand/eye coordination and fine motor skills necessary for scanning. Identify anatomical structures and basic pathology in images. Describe sonographic characteristics of structures in images. Describe 3 dimensional (3D) relationships of structures. Apply 3D, physics and anatomical/physiological knowledge to produce images. Integrate patient history with goals of the sonographic study. Vary scanning techniques to achieve required image results. Conduct organized and consistent scan routines. Perform independent sonographic examinations in the laboratory setting. Evaluate quality of studies performed. Apply feedback to improve performance. Demonstrate initiative, organization and team skills. Demonstrate appropriate patient care and professional interaction with other student "patients" to achieve desired results. Demonstrate consistent awareness and performance of safe ergonomic practice.	

2Theory = 2 credits	**Research Project (1)**	**RUS 411**
المتطلب السابق: **Biostatistics** **HRS 116**	This course covers topics which enable students to critically assess a medical research article and learn the steps involved in composing a literature review. The course is composed of five modules including Introduction to research, Types of Research, Common Statistical Concepts, Ethical Issues in Research and The Literature Review. This course will prepare students for research project II course where they will compose a literature review or perform a case study. • Discuss the purpose of research. • Compare and contrast different types of research including qualitative and quantitative research, applied research and experimental and non-experimental research. • Describe the components of a medical research article. • Critique the composition of a medical research article. • Describe common statistical terms. • Explain the main factors that influence common statistical calculations. • Discuss how ethical issues are applied in research. • Describe the basic ethical principles used in research. • Explore types of publishing and statistical bias. • Describe the steps involved in performing a comprehensive literature review. • Explore several different literature review resources and describe their strengths and weaknesses. Describe the components of a comprehensive literature review paper.	

2Theory + 1 Practical = 2 credits	Cardiovascular Physiology & Pathophysiology	RUS 412
المتطلب السابق: **Human Anatomy and Physiology (2)** **HRS 113** **Pathology** **RAD 223**	This course presents the construction and dynamics of the cardiovascular system in detail. Includes the development of the cardiovascular system, anatomical and physiological characteristics, heart sounds, biophysics of the cardiac cell, cardiac pumping action and its regulation, cardiovascular hemodynamics, coronary blood flow, systemic and pulmonic circulation and the control of regional circulation. It also provides an examination of the structure and function of the cardiovascular system in health and disease. This course emphasizes the pathophysiological mechanisms of acquired and congenital cardiovascular diseases as well as their clinical presentation, detection and treatment. • Able to presents the construction and dynamics of the cardiovascular system in detail. • Describe the development of the cardiovascular system, anatomical and physiological characteristics, heart sounds, biophysics of the cardiac cell, cardiac pumping action and its regulation, cardiovascular hemodynamics, coronary blood flow, systemic and pulmonic circulation and the control of regional circulation. • Provides an examination of the structure and function of the cardiovascular system in health and disease. Recognize and describe the pathophysiological mechanisms of acquired and congenital cardiovascular diseases as well as their clinical presentation, detection and treatment.	

2Theory + 1 Practical = 3credits	Cardiac Sonography& Procedures	RUS 413
المتطلب السابق: **Ultrasound Physics (1** **RUS 221** **Ultrasound Physics (2)** **RUS 313**	This course integrates anatomy, the cardiac cycle and hemodynamics with sonographic principles in the imaging of the heart. The focus of this course is on the assessment and interpretation of patterns in the normal heart as seen with 2 dimensional and m-mode imaging. Color and pulsed wave Doppler are introduced. The focus of this course shifts to the etiology, hemodynamics, sonographic patterns and quantification of cardiac disease. The course begins with modules on heart failure, systolic and diastolic performance abnormalities. Underlying mechanisms and therapeutic uses for common cardiac drug classes are covered. These concepts are then applied in modules on mitral regurgitation and stenosis. Students are challenged throughout this course to fully appreciate the many variables that are factors in the accurate assessment and documentation of cardiac pathology. Transesophageal imaging is introduced. Modules in this course also include aortic valve disease, right heart disease, prosthetic & percutaneous valves, coronary artery disease, cardiomyopathy, pericardial disease and pleural effusions. Advanced imaging techniques such as stress and contrast echocardiography are introduced. The role for complementary imaging such as nuclear medicine and magnetic resonance imaging is also included. The emphasis throughout this course is on the integration of clinical findings and hemodynamic changes with sonographic imaging in settings of cardiac disease. More modules covered in this course include cardiomyopathy, pericardial disease, cardiac masses, great vessels and congenital disease. The congenital module has an emphasis on conditions are repairs as seen in the adult population. Students in this course will apply covered concepts such as anatomy, physiology and altered hemodynamics to fully integrate the clinical and sonographic features of each condition.	

1 Theory + 2 Clnical = 3credits	Clinical Practicum (4)	RUS 414
المتطلب السابق: Clinical Practicum (1 RUS 311	Clinical Practicum IIIV (Cardiac) is the fourth clinical course in the program. Students in this course gain hands on experience in the settings of cardiac; may include on-campus laboratories, private office setting, as well as hospital rotations. Students who successfully complete this course will be able to satisfactorily perform portions of normal, uncomplicated studies with minimal assistance as defined in the Clinical Manual and individual clinical target summaries. Effective communication with patients and staff and safe practice are emphasized through all clinical courses in this program. • Interact with patients and their families and clinical staff in a professional manner. • Demonstrate effective and appropriate communication with patients, their families, and staff in the clinical environment. • Demonstrate strong initiative, organization and team skills. • Demonstrate effective time management. • Demonstrate safe ergonomic practices. • Exhibit professional behaviour and abide by BCIT and departmental dress codes. • Provide basic patient care (safety, washroom, oxygen, intravenous, infection control, transfer, trust) • Assess and monitor patient condition. • Prepare the scanner and patient for sonographic procedures. • Demonstrate effective use of scanner controls to optimize image quality. • Obtain satisfactory images of normal and abnormal structures with landmarks. • Perform portions of sonographic studies to levels as defined by the student's individual Clinical Target summary and as described in the Comptracker clinical assessment forms. • Obtain cardiac parasternal and 4-chamber apical views as defined in the term 1 Cardiac form. • Differentiate normal from abnormal findings. • Integrate knowledge of normal anatomy & physiology into sonograms. • Correlate clinical history and other diagnostic testing with sonographic findings • Participate in answering the clinical question in each patient situation. • Communicate the findings both in writing and verbally. Integrate principles of workplace safety into the clinical environment.	

1 Theory + 2 Clnical = 3credits	Breast Imaging	RUS 415
المتطلب السابق: **Human Anatomy and Physiology (2)** **HRS 113**	Traces the evolution of film-screen mammography and describes the physics and technology of breast imaging including digital mammography. Discusses radiation dose and risk considerations, radiation protection, quality assurance/control and the Mammography Quality Standards Act. Includes current research in breast imaging including other techniques such as ultrasound, MRI, digital tomosynthesis, laser CT imaging and nuclear medicine. Explores a range of topics essential to clinical breast imaging including: anatomy and physiology, pathology, patient care and communication, positioning, technique and film evaluation considerations as well as clinical assessment • Explain the physics of the radiation spectrum and its interaction with tissues in mammography. • Describe the equipment components which meet the imaging requirements of mammography • Describe the essential characteristics of digital mammography. • Outline the principles of stereotactic breast biopsy systems and describe patient positioning and sampling techniques with emphasis on the role of the mammographer during the procedure. • Outline the factors affecting dose in mammography. • Assess the impact of dose on the benefits and risks of mammography and summarize the results of several studies demonstrating benefits of screening mammography. • Outline quality assurance concepts and quality control procedures in mammography. • Outline the findings of current research studies and activities in breast imaging. • Outline the anatomy and physiology of the breast: o Describe the external and internal anatomy of the adult female breast. o Specify one method of breast delineation. o Describe the anatomy of the male breast. o List and define several anomalies of breast development. • Evaluate patient care issues related to imaging the breast in a clinical environment: o Thoroughly list the components of breast assessment. o Explain the uses and implementation of breast assessment.	

	○ List in detail and justify the components of a complete history. ○ Describe a method of accurate documentation of skin lesions. ○ Describe appropriate use of universal precautions and sterile technique. ○ Determine features of psychological, ethical and legal issues which are likely to be unique to the mammography patient. • Synthesize the clinical concepts related to positioning and imaging the breast: ○ Recognize optimal positioning technique and radiographic appearance for the following general projections: CC, MLO, LMO, ML, LM. ○ Recognize optimal positioning technique and radiographic appearance for the following supplemental projections and positions: AT, 30 Reverse Oblique, EXCC, SIO, FB, coned compression spot views, open compression microfocus magnification views, cleavage, rolled position, tangential, Lumpogram, Axillary view, techniques for the augmented breast. • Assess the technical and clinical components of mammographic image quality: ○ Manipulate suboptimal technical parameters to appropriately correct an identified image problem. ○ Specify necessary radiographic documentation. ○ List in detail the components of image quality assessment. • Outline the breast pathology demonstrated by breast imaging techniques: ○ Describe the origin and common radiographic characteristics of several benign breast diseases such as cysts, fibroadenoma, lipoma, hamartoma and hematoma. ○ Describe the origin and common radiographic appearance of ductal carcinoma in situ and invasive carcinoma. ○ Describe common characteristics of the following malignant tumors: medullary, mucinous and papillary carcinoma, metastasis and phyllodes tumor. ○ Explain the differentiating factors of abscess, mastitis, gynecomastia and lymphatic inflammation. ○ Associate skin lesions and changes with appropriate pathology. Given the characteristics of a certain mass or calcification, classify if likely malignant or benign.