



Ministry of National Health Services

Regulation & Coordination, Government of Pakistan

Health Services Academy (DAI), Islamabad

Collaboration with

Institute of Allied Medical Professions

POST GRADUTE DIPLOMA IN DIAGNOSTIC ULTRASOUND (D.D.U)

POST GRADUTE
Diploma in Diagnostic Ultrasound (D.D.U)
MBBS (For Medical Graduates) & B.S Allied Health Profession

Introduction: Health care practices are evolving and improving each day. As soon a patient visits emergency room/physician's Clinics or diagnostic centre, he/she wishes to get examination process completed soon. Physicians treating the patient also share the same wish as the patient because this not only impacts health but time and cost too.

Ultrasound Diagnostic examination is well trusted by physicians and surgeons as non-invasive first line of diagnostic process. Ultrasound is a safe and widely available diagnostic tool. Ultrasound as the name indicates uses sound waves rather than ionizing radiations which is a major benefit of the examination. The level of knowledge and training on the part of practitioners is accordingly highly diverse. Worldwide, there is great variation in both the sophistication of ultrasound equipment and the qualifications of those providing diagnostic ultrasound services.

The versatility of ultrasonography in assisting the diagnosis of a broad range of diseases along with the widespread availability of low-cost general-purpose scanners with superior performance has encouraged the use of diagnostic ultrasound throughout general medicine and paediatrics, Surgery practice and other specialties.

Medical specialists other than radiologists are increasingly wishing to undertake ultrasound examinations on patients referred to them for their clinical opinion as a direct extension of their clinical examination. This may take place in the outpatient department, on the wards and in the assessment of emergency patients. Clinicians are also using ultrasound to assist in practical procedures such as central line insertion.

Physicians are eligibility to appear recently, the American College of Graduate Medical Education (ACGME) registration through examination in Pakistan in a joint initiative with the American Board of Radiology revised the criteria by which each Diploma in Diagnostics Medical Ultrasound is expected to be evaluated during their training years.

The Diploma in Diagnostic Ultrasound (D.D.U) provides a combination of academic and clinical elements signifying the importance of ensuring graduates from this programme will be eligible for registration with the regulatory body in the ultrasound scope of practice.

The requires education providers to ensure that graduates have a sound knowledge and skills base to practice as a Sonologist M.B.B.S with PM&DC registration (Level-II(a))

Preferably House job in Radiology or one year training in Designed for medical professionals wishing to obtain further expertise in ultrasound for clinical practice. This course is particularly valuable for rural GPs, anaesthetists, GPs, emergency physicians, surgeons and cardiologists, and other medical specialists. Allied health specialists are interested in completing individual subjects to enhance their practice.

MBBS/ BDS (Level-I) after one year house job, PM&DC Register as Diploma Level (II-a)
12-month course work.

Registered with PM & DC: Level-II(a) Or II(b): After complete D.D.U course work mandatory to complete logbook one thousand (1000) Cases unaided in one specialty under the supervision of relevant subjects. Level-II(b) Equivalent M.Sc.

B.S. (16) years, Allied Health Professions

B.S Medical Imaging with safety and effectively by meeting the criteria for competence in ultrasound. Allied Health Professions Council Register conduct examination for registrations. Medical Imaging with D.D.U

B.S(16) years Of Allied Health Profession: i.e., MIT or MID After complete D.D.U Registration with Allied Health Professions Council Act,2022

Private Practice in Health care will be allowed after passing Licensing examination.

Program Overview: The specializations Diploma in Diagnostic Ultrasound are consisting of **32 to 36 credit Hours** of taught coursework and can be completed in **12 months**.

Students will be expected to spend approximately 15 hours of study for **each 3-credit hour** course. In specializations with a clinical requirement (such as ultrasound) All courses will be delivered fully online, **30 %** attendance ,**70%** passing course work is mandatory.

Each student is required to complete **09 courses**, all of which are compulsory (**27 credit hours**) prerequisite in first semester (Two courses), second semester (One Course) 09 credit Hours being common to all Medical. Graduates and B.S Allied Health Professionals

Scheme of Studies POST GRADUTE Diploma in Diagnostic Ultrasound (DDU)

Course Code	Course Title	Credit Hours
DMU 201	Ultrasound Physics & Instrumentation	03(3,0)
DMU 202	General Abdomen	04(3,1)
DMU 203	Clinical Applications Ultrasound Abdominal	03(3,0)
DMU 204	<i>Introduction of Ultrasound</i>	02(2,0)
DMU301	Imaging Anatomy and Pathology	03(3,0)
DMU302	OB GYN Ultrasound	04(3,1)
DMU 303	Second and Third Trimesters	02(2,0)
DMU304	Ultrasound Clinical Applications: Obstetrics & Gynaecology	03(3,0)
DMU 305	Principles of Clinical Ultrasound	03(3,0)
DMP401	Fundamental Medical Physics	03(3,0)
MTH 402	Fundamental Calculus	03(3,0)
SDP403	Essentials DICOM & PACS	03(3,0)
	Total	36

Schedule of courses (Semester Wise)
POST GRADUTE
Diploma in Diagnostic Ultrasound (D.D.U)

Semester-I

Course Code	Course Name	Credit Hours
DMU 201	Ultrasound Physics & Instrumentation	03(3,0)
DMU 202	General Abdomen	04(3,1)
DMU 203	Clinical Applications Ultrasound Abdominal	03(3,0)
DMU 204	Introduction of Ultrasound	02(2,0)
Prerequisite		
DMP401	Fundamental Medical Physics	03(3,0)
MTH402	Fundamental Calculus	03(3,0)
	Total	18

Semester-II

Course Code	Course Name	Credit Hours
DMU 301	Imaging Anatomy and Pathology	03(3,0)
DMU302	OB GYN Ultrasound	04(3,1)
DMU303	Second and Third Trimesters	02(2,0)
DMU304	Ultrasound Clinical Applications: Obstetrics & Gynaecology	03(3,0)
DMU305	Principles of Clinical Ultrasound	03(3,0)
Prerequisite		
SDP 403	Essentials of DICOM & PACS	03(3,0)
		18

Note: Each subject has one Specialty (i.e.) OBGYN / General (Abdomen) *as this course is a prerequisite for all the other ultrasound-specific courses, it is expected that students complete this in the first semester of their programme of study

International Faculty Online (USA) Expert in their subject specialty OB GYN, General (Abdomen)

Intended Learning Outcomes

Knowledge: Diploma Diagnostic Ultrasound should have acquired:

- **A body of knowledge** that includes the understanding of recent developments in a discipline and/or area of professional practice in the discipline of Clinical Ultrasound
- **Knowledge of research principles** and methods applicable to learning in the discipline of Clinical Ultrasound.

Skills: Diploma Diagnostic Ultrasound will have developed:

- **Cognitive skills** to demonstrate proficiency in theoretical knowledge of clinical ultrasound and to reflect critically on theory and professional practice or scholarship Cognitive, technical, and creative skills to investigate, analyses and synthesis complex information, problems, concepts, and theories and to apply established the practice of clinical ultrasound Cognitive, technical, and creative skills to generate and evaluate complex ideas concepts at an abstract level
- **Communication and technical research skills** to justify and interpret theoretical propositions, methodologies, conclusions and professional decisions to specialist and non-specialist audiences Technical and communication skills to design, evaluate, implement, analyses, theories about developments that contribute to professional practice or scholarship.
- **Application of Knowledge and Skills:** Diploma Diagnostic Ultrasound will demonstrate the application of knowledge and skills: With creativity and initiative to new situations in professional practice and/or for further learning, With high-level personal autonomy and accountability. To plan and execute a substantial capstone experience to new situations in professional scientific practice and/or for further learning.

Career outcomes: As clinical ultrasound technology becomes more widely accessible, medical professionals with relevant knowledge are increasingly sought after.

- This program can help you develop the skills to confidently undertake clinical ultrasound within your existing practice.
- This course does not qualify you to be a sonographer. It is for those medical health practitioners who wish to incorporate ultrasound into their practice.

PG Diploma with relevant Specialties: 06

- OB GYN Ultrasound
- Gastrointestinal Ultrasound (Abdomen)
- Urological Ultrasound
- Neo natal Ultrasound
- Vascular Ultrasound
- Small Parts Ultrasound (Thyroid, Breast & Prostate)

Each Specialty must enrol students at least 20-25 to offer a program.

Prerequisite: for Medical Physics & Calculus, essentials DICOM & PACS

After Completing D.D.U are eligible to appears USA licensure examination which worldwide recognizes, American Registry Medical Diagnostic Sonography (ARDMS)

Physician Only Certification

- **RMSK®** Registered in Musculoskeletal® sonography,
- **RPVI®** Registered Physician in Vascular Interpretation®
- **CBCCT™** Certification Board of Cardiovascular Computed Tomography™
- **CBCMR** Certification Board of Cardiovascular Magnetic Resonance
- **CBNC™** Certification Board of Nuclear Cardiology™

Detail Course

Course Code: DMS 201

Course Title: Ultrasound Physics & Instrumentation

Credits Hour: 03(3,0)

Course Content: Ultrasound is a powerful tool for discerning the shapes, sizes, and textures of structures, their locations, and their spatial relationships. To optimize diagnostic images and operate safely, it is essential to understand fundamental principles of ultrasound.

1. ***To select a transducer that will provide optimal penetration of the anatomic region of interest:*** Understand relationships between frequency, penetration, and resolution; and recognize how a transducer's footprint size and shape facilitate beam access to target structures.
2. ***To maximize sound wave transmission to, and echo acquisition from, target structures:*** Understand how ultrasound energy is affected by the medium it is traveling through, why reflection, refraction, and/or scatter occur at tissue boundaries, and how the angle of the beam affects the image quality of a target structure and be able to angle the beam effectively to avoid barriers to transmission and maximize the strength of echoes returning from tissue boundaries.
3. ***To maximize image quality:*** Understand how to use the machine to optimally adjust characteristics of the transmitted beam and/or “received” echo information.
4. ***To accurately interpret images:*** Recognize tissue characteristics by sonographic appearance; recognize and understand the types of artifacts; use helpful artifacts as a source of additional diagnostic information; and reposition the transducer to reduce or eliminate distracting artifacts.
5. ***To keep the potential for bioeffects as low as reasonably achievable (ALARA):*** Understand the thermal and mechanical effects of sound energy on tissue; know which tissues are most vulnerable; and understand how to adjust the unit to produce optimal images with the least output intensity.
6.
 - I. **Ultrasound Physics Learning Objectives**
 - A. Describe the basic physics of ultrasound, including:
 1. Waves
 2. Wavelength
 3. Frequency
 4. Harmonics

5. Propagation speed
6. Amplitude
7. Intensity
8. Attenuation
9. Absorption
10. Impedance
11. Reflection
12. Refraction
13. Transmission
14. Scattering

II. Instrumentation

Transducers Learning Objectives:

Describe transducer types:

- a. Linear array
- b. Convex array
- c. Phased array
- d. Vector array

2. Describe transducer choices for various applications.

A. Instrumentation Learning Objectives:

1. Describe ultrasound instrument organization:

- a. Transducer
- b. Beam former.
- c. Signal processor
- d. Image processor
- e. Display
 - 1) Detail resolution
 - 2) Contrast resolution
 - 3) Temporal resolution

2. Describe ultrasound instrument functions used for image optimization:

- a. Preset
- b. Frequency
- c. Depth
- d. Focus
- e. Gain
- f. Time-gain compensation
- g. Output power
- h. Freeze
- i. Callipers/measure
- j. Video clips

3. List ultrasound imaging modes and describe their applications:

- a. Brightness B-mode (Gray scale)
- b. Motion M-mode
- c. Colour Doppler
- d. Power Doppler
- e. Spectral Doppler

III. Artifacts Learning Objectives:

1. List common types of artifacts occurring with anatomic Gray Scale and Doppler imaging:

- a. Shadowing
- b. Enhancement
- c. Comet tail
- d. Ring-down
- e. Mirror image
- f. Reverberation
- g. Refraction
- h. Speed error
- i. Grating lobe
- j. Slice (section) thickness
- k. Noise
- l. Aliasing

2. Describe techniques to minimize artifacts.

3. Describe techniques for determining whether an observation is real or artifactual.

4. List artifacts that are diagnostic.

VI. Safety Considerations Learning Objectives:

1. Describe thermal and nonthermal bioeffects mechanisms.
2. Describe the thermal index (TI).
3. Describe the mechanical index (MI).
4. Explain the ALARA principle.
5. Describe methods for implementing ALARA.
6. List official statements regarding patient safety standards and ethical scanning practices.

Recommended reference Textbooks:

1 Kremkau FW. *Sonography: Principles & Instruments*. 10th ed. St Louis, MO: Elsevier. In press.

3 Wagner PR, Hedrick WR. *Point-of-Care Ultrasound Fundamentals: Principles, Devices, and Patient Safety*. New York, NY: McGraw-Hill Education; 2021

American Institute of Ultrasound in Medicine. As low as reasonably achievable (ALARA) principle; 2018. American Institute of Ultrasound in Medicine website. <https://www.aium.org/officialStatements/39>. Accessed December 18, 2020.

American Institute of Ultrasound in Medicine. Prudent Clinical Use and Safety of Diagnostic Ultrasound; 2019. American Institute of Ultrasound in Medicine website. <http://www.aium.org/officialStatements/34>. Accessed June 6, 2019.

Course Code: DMU 202
Course Title: Abdomen (General)
Credits Hour: 03(3,0)

Course Objective:

- Increase the participants' knowledge to better perform diagnostic ultrasound examinations.
- Apply knowledge of the abdominal cross-sectional anatomy, scan protocols, laboratory values and routine measurements associated with the abdominal ultrasound examination.
- Recognize normal imaging characteristics of the liver, gallbladder, pancreas, spleen, kidneys, adrenals, and abdominal vasculature.
- Integrate imaging characteristics of commonly seen pathology associated with the liver, gallbladder, pancreas, spleen, kidneys, retroperitoneum, and abdominal vasculature.
- Differentiate normal and abnormal sonographic characteristics associated with evaluation of superficial structures such as thyroid, testes & scrotum and some basic musculoskeletal structures.

Course Contents:

Abdominal Vasculature, Muscular, and Bony Anatomy

- Liver Anatomy and Physiology
- Liver Pathology
- Gallbladder and Biliary Tree Anatomy/Physiology & Pathology
- Trauma Ultrasound
- Pancreas Anatomy and Physiology
- Pancreas Pathology
- Spleen Anatomy, Physiology, & Pathology
- Renal Anatomy & Physiology
- Renal Pathology
- Superficial Structures: Thyroid, Scrotal, and Breast
- Two Mock Examinations

Recommended Textbooks:

Diagnostic Imaging: Abdomen by Michael P Federle MD FACR (Author), R. Brooke Jeffrey MD (Author) Abdominal Ultrasound by Carol A. Mittelstaedt (Author), Lawrence M. Vincent Advanced Imaging of the Abdomen by Jovita's Skuas (Author)

Course Code: DMU 203

Course Title: Clinical Applications Ultrasound Abdominal

Credits Hour: 03(3,0)

Course Objective: Recent advances in ultrasound technology, resulting in portable machines of high quality and a lower cost, have facilitated the rapid adoption of ultrasound imaging at the point of care.

Trained clinicians in many areas of health care perform and interpret ultrasound studies to aid in the evaluation and management of their patients. An advantage of point-of-care ultrasound is that the clinician can use the information derived from the ultrasound as part of the real-time evaluation and management process. The efficiency of point-of-care ultrasound promotes optimal and timely patient care.

Courses Contents:

Clinical Integration: For common core applications, learning objectives should ensure sufficient emphasis on how to appropriately integrate point-of-care ultrasound findings into clinical use, including awareness of perit Abdomen. Point-of-care ultrasound adds important additional information regarding key findings in the abdomen. Free fluid, bladder distension, hydronephrosis, small-bowel obstruction, and cholelithiasis are examples of pathologies that can all be detected with point-of-care ultrasound.

I .Evaluation for Free Fluid

Learning Objectives: Be able to:

Identify normal abdominal anatomy, including the diaphragm, liver, spleen, kidneys, and bladder. Demonstrate right upper quadrant, left upper quadrant, and pelvic areas where free abdominal fluid can accumulate. Recognize pathologic free fluid in any of the three above areas.

II Renal and Bladder

Learning Objectives: Be able to:

Identify the right and left kidneys and bladder in short and long axes. Differentiate the renal cortex and renal pelvis based on their ultrasound appearance. Distinguish between the presence and absence of hydronephrosis (also using colour Doppler imaging). Perform measurement of bladder volume. Identify the prostate gland and/or uterus if present. Recognize the presence of renal, ureteral, or bladder stones. Recognize sources of urinary retention (including prostatic enlargement).

IV. Scrotal

Learning Objectives: Be able to:

List indications for scrotal ultrasound. Recognize scrotal skin edema and free fluid (hydrocoele). Recognize normal and abnormal appearances of testicular echogenicity. Discuss the use of colour, pulsed wave, and power Doppler imaging in the evaluation of testicular torsion, inflammation, and evaluation of testicular masses.

V. Hepatobiliary

Learning Objectives: Be able to:

Identify basic hepatobiliary anatomy, including the liver, biliary tract, and gallbladder. Use colour Doppler imaging to identify vessels. Recognize the appearance of cholelithiasis and gallbladder sludge. Demonstrate assessment of the sonographic Murphy sign. Recognize findings suggestive of cholecystitis, including gallstones, pericholecystic fluid, wall thickening, and abscess.

V. Bowel

Learning Objectives: Be able to:

Identify the normal small bowel and peristalsis if present. Describe findings associated with small- and large-bowel obstruction. Identify and describe findings associated with pyloric stenosis in paediatric patients. Identify and describe findings associated with appendicitis. Identify and describe findings associated with intussusception.

For each clinical application: Critically appraise current evidence on clinical use. Apply diagnostic accuracy parameters (sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio). Integrate information obtained from point-of-care ultrasound examinations with clinical information.

Recognize limitations and when consultation and/or comprehensive imaging is required. **outlines a foundational knowledge and skill set for any student or clinician.** It is important to acknowledge that different specialties will acquire a much more advanced skill set in their area, and this document is not meant to replace specialty or practice-specific use and guidelines.

Abdomen (General): Point-of-care ultrasound adds important additional information regarding key findings in the abdomen. Free fluid, bladder distension, hydronephrosis, small-bowel obstruction, and cholelithiasis are examples of pathologies that can all be detected with point-of-care ultrasound.

Recommended Textbooks:

Clinical Sonography: A Practical Guide 5th Ed. by Roger C. Sanders (Author)

Workbook and Lab Manual for Sonography 5th Ed. by Reva Arnaz Curry PhD RDMS RTR
FSDMS (Author), Marilyn Prince (Author)

Workbook for Textbook of Diagnostic Sonography 8th Edition by Sandra L. Hagen-Ansett
MS RDMS RDCS FASE FSDMS (Author)

Course Code: DMU 204

Course Title: Introduction of Ultrasound

Credits Hour: 03(3,0)

Course Objective: Whether you are a beginner or a seasoned D.D.U students. We will be offering a course for beginners. This will include didactic sessions on Physics, Trauma exam (FAST), Abdominal Aorta and Ultrasound assisted procedures (including central line placement).

Half of your time will be spent in small groups scanning models with a very favourable instructor/student ratio. Physicians who have already taken an introductory course will have an opportunity to build their own ultrasound course in our advanced modules.

These will be structured to maximize “hands-on” scanning of models. Modules will be offered in OB/GYN scanning (including endovaginal), The faculty will include physicians with international reputations as outstanding ultrasound educators.

Learning Objectives Upon completion of this course participants will be able to:

Gallbladder, Renal & Aorta:

1. Understand the surface landmarks for appropriate transducer positioning to perform sonographic examinations of the Aorta, Kidney, and Gallbladder.
2. Understand the sonographic windows and landmarks of the Aorta, Kidney, and Gallbladder
3. Demonstrate the ability to identify and visualize landmarks for the Aorta, Kidney and Gallbladder in the transverse and longitudinal scanning planes.
4. Understand the sonographic findings and pitfalls for identifying pathology including aortic aneurysm, hydronephrosis and cholelithiasis/cholecystitis.

Equipment:

1. Learn to be an expert on your own equipment.
2. Learn how to safely connect and remove probes from their ports.
3. Learn how to switch between transducers.
4. Learn and demonstrate how to store and review images.
5. Demonstrate adjustments to controls i.e., gain, depth, frequency in hands- on session.
6. Demonstrate how to properly document an ultrasound study by adding pt. information, text annotation and proper landmarks.

The Fast Examination:

1. Understand the surface landmarks for appropriate transducer positioning to perform the FAST examination.
2. Understand the sonographic landmarks and anatomical relationships of the Heart, Liver, Spleen and Bladder as they relate to the FAST examination.
3. Demonstrate the ability to identify and visualize the areas of potential intra-abdominal and thoracic spaces for free fluid to collect in on the FAST examination.
4. Understand the sonographic findings and pitfalls for identifying life threatening, trauma conditions such as cardiac tamponade, hemo/pneumothorax, and intra-abdominal haemorrhage.

Gastrointestinal:

1. Understand the sonographic appearance of normal stomach, large and small bowel, and pancreas, including normal anatomical structures and normal bowel peristalsis.
2. Describe transducer choices, scanning protocols and patient positions necessary to perform a gastrointestinal examination.
3. Identify and detect gastrointestinal pathology such as ileus, pneumoperitoneum, appendicitis, colitis, diverticulitis, ileitis, intussusception, or hernias.
4. Describe common sites of intra-and retroperitoneal free air, systematic examination techniques and pitfalls for appendicitis, pneumoperitoneum, colitis, diverticulitis, and hernia.

First Trimester Pelvic:

1. Understand the indications for emergency screening ultrasound examinations of the pelvis.
2. Describe the surface landmarks and transducer position necessary to perform transabdominal and endovaginal ultrasound examinations of the pelvis.
3. Perform an endovaginal US on model patients demonstrating correct scanning technique.
4. Interpret common diagnoses in first trimester pregnancy.

Starting an Ultrasound Program:

1. Review the responsibilities of the ultrasound director.
2. Review the requirements for training faculty and residents and discuss the process of privileging faculty to perform emergency ultrasound.
3. Review how to establish a quality assurance process and how to report, document and archive images for both teaching and clinical use.
4. Review equipment necessary to begin a successful program.
5. Share public domain resources others have used in program initiation

Learning outcomes: After successful completion of this unit, students will be able to:

1. Identify and describe the normal structure and function of common anatomical regions that are visualized in medical ultrasound;
2. Describe and discuss the major stages of embryology, and the specific embryonic development of the digestive, genitourinary, and central nervous system;
3. Identify and explain the Ultrasound Physician role and professional requirements;
4. Explain ethical and medico-legal considerations and apply culturally appropriate professional communication skills; and
5. Integrate safe ergonomic principles in beginning clinical scanning skills.

Recommended Textbooks:

Essentials of Medical Ultrasound: A Practical Introduction to the Principles, Techniques, and Biomedical Applications by Michael H. Repac Holi (Author), Deirdre A. Bennell (Author)
Introduction to Bedside Ultrasound Matthew Dawson & Mike Mullin

Course Code: DMP401

Course Title: Fundamental Medical Physics

Credits Hour: 03(3,0) Prerequisite

Course Description: Introduction to Medical Physics An introduction to key physical principles as applied to medical imaging and radiation therapy.

Topics: covered will include imaging metrics, ionizing radiation and radiation safety, radioactivity, radiation therapy, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.

Course Objectives:

- Develop basic understanding of medical physics concepts,
- Develop problem-solving and critical-thinking skills,
- Learn to integrate and apply various physics concepts to a single problem,
- Develop scientific communication skills.

Learning Objectives: By the end of the course, students will be expected to be able to

- Describe an imaging system and break it down into its components and physical principles, for each of the imaging modalities covered (x-ray, CT, NM, US, MRI).
- Identify the key factors that affect image quality and address these factors for the different imaging modalities.
- Learn to communicate the physical principles behind medical technology, radiation safety, and relevant applications.

Course Outline:

1. **Medical physics and imaging principles:** intensity, resolution, contrast
2. X-ray physics: photon interactions, attenuation
3. X-ray imaging: x-ray production & detection, mammography, computed tomography
4. Nuclear medicine physics: radioactivity
5. Nuclear medicine imaging: radioisotope production, SPECT, PET
6. Radiation exposure physics: radiobiology, dosimetry, karma
7. Radiation exposure principles: safety, risk, radiation therapy, radiation protection
8. Ultrasound physics: waves, reflection, transmission, attenuation
9. *Ultrasound imaging principles:* echoes, resolution, speckle, Doppler
10. Nuclear magnetic resonance physics: magnetic moment, magnetization, relaxation
11. Nuclear magnetic resonance spectroscopy (NMRS) and imaging (MRI) principles: chemical shift, magnetic resonance signal induction and relaxation, pulse sequences, spatial encoding.

Recommended Textbook: Medical Imaging Physics, by W.R. Hendee and E.R. Ritenour, ISBN 0471382264

Other resources for reference:

- Physics of Radiology, A.B. Wolbarst, ISBN 0838557694
- The Essential Physics of Medical Imaging, J.T. Bush Berg, et al., ISBN 0683301187

Course Code: MTH 402
Course Title: Fundamental Calculus
Credits Hour: 03(3,0) Prerequisite

Course Objective: Upon completion of the course, students will be able to:

- Understand the basic limit and continuity of a function and apply it upon various polynomial, root, trigonometric, logarithmic, and exponential functions.
- grasp the concept of derivative of a function and applying different techniques to differentiate and optimize various functions.
- Handle indefinite integral of a given function and to be able to apply it for finding the areas between the curves and finding the volumes.

Calendar of Course contents to be covered during semester

Week	Topics	Exercise
1	Inequalities, Lines, Circles, and Parabolas	1.1, 1.2
2	Functions and Graphs, Trigonometric Functions, Calculating Limits Using the Limit Laws	1.3, 1.6, 2.2
3	One-Sided Limits and Limits at Infinity, Vertical Asymptotes, Continuity	2.4, 2.5, 2.6
4	Equation of tangent, The Derivative as a Function, Differentiation Rules	2.7, 3.1, 3.2
5	Derivative as a Rate of Change, Derivatives of Trigonometric Functions, The Chain Rule, and Parametric Equations	3.3, 3.4, 3.5
6	Implicit Differentiation, Extreme Values of Functions	3.6, 4.1
7	The Mean Value Theorem, Monotonic Functions and The First Derivative Test, Indeterminate Forms and Hospital's Rule	4.2, 4.3, 4.6
8	Revision of previous topics followed by MID TERM EXAMINATION	
9	The Fundamental Theorem of Calculus, Indefinite Integrals, and the Substitution Rule	5.4, 5.5
10	Basic Integration Formulas, Integration by Parts	8.1, 8.2
11	Integration of Rational Functions by Partial Fractions Trigonometric Integrals	8.3, 8.4
12	Trigonometric Substitutions, Improper Integrals	8.5, 8.8
13	Natural Logarithms, The Exponential Function	7.2, 7.3
14	a^x and $\log ax$, Hyperbolic Functions.	7.4, 7.8
15	Revision of previous topics followed by Final TERM EXAMINATION	

Recommended Textbooks: M.D. Weir, J. Hass & F.R. Giordano. *Thomas' Calculus*, Pearson Education, latest edition.
Reference Books: Swokowski, Olinick and Pence, *Calculus and Analytical Geometry*, 6th edition, 1994, Brooks/Cole Publishers
Howard Anton, *Calculus*, 7th edition, 2002, John Wiley and Sons (WIE) William E. Boyce Richard C. Diprima, *Calculus*, John Wiley and Sons, ISBN: 0471093335. Erwin Kreyzing, *Advanced Engineering Mathematics*, 7th edition, 1993, John Wiley and Sons

Course Code: SDP403

Course Title: Essentials of DICOM & PACS

Credits Hour: 03(3,0) Prerequisite

Course Outline Course: This instructor-led course prepares the participant to become proficient in the installation, maintenance and troubleshooting of DICOM on digital imaging networks. Participants will learn to use the DICOM standard as a reference source, analyze conformance statements for predicting connectivity, configure and use DICOM simulators, and capture and analyze DICOM traffic using freeware tools like the DICOM Validation Toolkit.

Prerequisites/Required Skills/Pre-course Work: Essentials of Healthcare IT or equivalent Location: Healthcare facilities.

Course Objectives:

- Identify the types of devices and their uses on a digital imaging network.
- Understand digital imaging workflow.
- Identify where DICOM is used on a network.
- Learn to troubleshoot connectivity across the layers of the OSI model within an imaging network, and isolate network connectivity issues from DICOM configuration issues.
- Learn how to use the conformance, information object definition, service class specifications, and data dictionary sections of the DICOM standard.
- Analyze commonly including verify, store, store commit, print, query retrieve, MPPS.
- Locate DICOM conformance statements on the Internet.
- Compare DICOM conformance statement to predict connectivity between devices.
- Demonstrate proficiency with the basic configuration requirements for DICOM connectivity.
- Master the use of DICOM simulators, including DICOM Validation Tool Kit
- Demonstrate proficiency in the recording, playback, and analysis of network sniffers such as DICOM Validation Tool Kit

DICOM is an industry standard that is designed to allow easy communication across multiple modalities among multiple manufacturers. What does that mean? It means that all medical machines that are DICOM compliant must speak the same language when they send information across the network. This allows the person reading the studies to have one piece of software (a DICOM reader) to read the studies. Before DICOM, manufacturers each had their own language and it required multiple software programs to read the studies.

PACS is a complete image archival and storage system and is what receives, and archives images transferred via DICOM. it describes the computer servers that receive the patient data and images. PACS can be a server in your office, a cloud, or hospital IT department. You do not need PACS to read DICOM. PACS is just a term to describe a system that may include a DICOM server that receives the images you send in the DICOM format.

Recommended Textbooks: Digital Imaging and Communications in Medicine (DICOM): A Practical Introduction and Survival Guide by Oleg S. Panych (Author) PACS: A Guide to the Digital Revolution by Keith J. Dreyer (Editor), David S. Hirschhorn (Editor), James H. Thrall (Editor), & 1 more **DICOM Basics** by Herman Oestrike (Author)

Course Code: DMU 301

Course Title: Imaging Anatomy and Pathology

Credits Hour: 03(3,0)

Course Objective: to enhance the student's clinical reasoning skills and to enable them to evaluate the use of a variety of imaging modalities in patient diagnosis and management. It will extend students' overall professional competence through an academically applied level of understanding of clinical science. Anatomical knowledge of various systems and associated pathological processes will be developed, linked to their functional and clinical relevance.

Course Contents: the principles of medical science at whole body, organ, tissue, cellular and sub cellular levels by developing an integrated understanding of anatomy and pathology as it applies to medical imaging in the clinical context.

Specific anatomical regions and pathologies will be investigated to explain imaging appearances and evaluate the role of a variety of imaging modalities in patient pathways.

Learning activities and assessments are designed to support the development of not only clinical competency, but also growth holistically as a reflective practitioner.

Medical Imaging endorsed programmes: Medical Imaging, MRI, Nuclear Medicine Ultrasound and Medical Imaging. It may be completed as the elective course for the Mammography program.

Delivery Mode (Online): The course will include live online events including tutorials and these will be recorded. Where possible, study material will be available at course commencement. This course runs to the University semester timetable and all the associated completion dates and deadlines will apply.

Learning Resources: There are no required textbooks for this course. Students will be directed to a full selection of readings and other resources that will be able to be accessed online.

Recommended Textbooks:

Medical Imaging of Normal and Pathologic Anatomy by Joel A. Vilensky (Author), Edward C. Weber (Author), Stephen W. Carmichael (Author)

Medical Imaging of Normal and Pathologic Anatomy - Elsevier eBook on VitalSource (Retail Access Card) 1st Edition by Joel A. Vilensky PhD (Author), Edward C. Weber DO (Author), Thomas Sarosi MD

Course Code: DMU 302

Course Title: OB GYN Ultrasound

Credits Hour: 03(3,0)

Course Description: This course is designed for preparation for the OB/GYN ultrasound. Sections include General Information and Embryology, Normal Pelvic Structures, Abnormalities of the Uterus and Ovaries, 2nd / 3rd Trimester Assessment, Fetal and Maternal Doppler. Fetal Anomalies are separated into categories relating to location.

The course materials are also an excellent resource to brush up on current topics in the field.

Course Objectives: Upon completion of the course, the Sonographer should be able to:

- Identify normal female pelvic anatomy.
- Describe the stages in the menstrual cycle and involved organs.
- Identify congenital anomalies of the female pelvic organs.
- List and describe benign and malignant findings in the uterus and ovaries.
- Describe the process of fertilization and implantation, including normal findings on physical exam and ultrasound evaluation.
- Define the components of a first trimester, second trimester and 3rd trimester ultrasound exam.
- Identify normal Fetal anatomy and biometry in all three trimesters.
- Differentiate normal and abnormal placental findings.
- Identify Fetal anomalies of head, face, neck, spine, chest, umbilical cord, GI tract, GU tract, cardiovascular system, and extremities.
- List and describe Fetal anomalies associated with chromosomal anomalies.
- Describe the normal and abnormal findings related to multiple gestations.
- Identify normal and abnormal Doppler flow patterns in the pregnant and non-pregnant uterus.
- List and describe maternal health issues affecting pregnancy and delivery.
- Define several invasive and non-invasive methods of evaluating Fetal well-being during pregnancy.

Recommended Textbooks:

- Hacker & Moore's Essentials of Obstetrics and Gynaecology, by: Neville F. Hacker, Joseph C. Gambone DO, Calvin J. Hobel
- Current Obstetric & gynaecological Diagnosis & Treatment, By: Alan H. DE Cherney, Lauren Nathan
- Obstetrics by Ten Teachers, By: Professor Philip N. Baker, Dr. Louise Kenny
- Gynaecology by Ten Teachers, By: Ash Monga, Dr. Stephen P. Dobbs
- **Ultrasound in Obstetrics and Gynaecology: A Practitioner's Guide** by Kathryn A. Gill (Author, Editor), Stephen Beebe; Jim Baun (Illustrator) **Atlas of Ultrasound in Obstetrics and Gynaecology: A Multimedia Reference** by Ph.D. Doublet, Peter M., M.D. (Author), M.D. Benson, Carol B. (Author) **Ultrasound Diagnosis in Obstetrics and Gynaecology** Authors: Manfred Hensman,

Course Code: DMU 303

Course Title: Second and Third Trimesters

Credits Hour: 03(3,0)

Course Objective:

- Describe the general technique to perform an ultrasound evaluation during the third trimester of pregnancy.
- Identify the indications and contraindications for performing an ultrasound evaluation during the third trimester of pregnancy.
- Describe the typical Fetal and maternal ultrasonographic findings during the third trimester of pregnancy.
- Summarize the most common pathologic findings that can be appreciated when performing an ultrasound evaluation during the third trimester of pregnancy.

In an asymptomatic, gravid female, third-trimester ultrasound is indicated for the evaluation and determination of:

1. Fetal anatomy
2. Fetal anomalies
3. Gestational age
4. Fetal growth
5. Fetal presentation
6. Suspected multiple gestations.
7. Placental location
8. Cervical insufficiency

Third-trimester ultrasound examination on the symptomatic pregnant patient has multiple indications, including, but not limited to, the following conditions:

1. The discrepancy between the uterine size and calculated gestational date.
2. Pelvic mass
3. Ectopic pregnancy
4. Fetal death
5. Fetal anomaly
6. Vaginal bleeding
7. Abdominal or pelvic pain
8. Hydatidiform mole
9. Uterine abnormalities
10. Fetal abnormalities
11. Amniotic fluid abnormalities
12. Placental abruption
13. Premature rupture of membranes
14. Premature labour
15. Placenta previa
16. Additionally, other applications of ultrasonography include acting as an adjunct to procedures, e.g., amniocentesis, cervical cerclage placement, external cephalic version.

A particular patient population that is especially benefited from using ultrasound in the third trimester is the late presenter without prior prenatal care. Unfortunately, these patients are prone to all disorders, and an ultrasonographic evaluation is of paramount importance to avoid, or at least plan for, significant morbidity and mortality causes.

Equipment: A more detailed and specialized examination of Fetal anatomy and characteristics of the placenta may be required under certain clinical circumstances

For appropriate sonographic evaluation, two probe transducers must be available.

A curvilinear probe (1 to 6 MHz) is the preferred probe for transabdominal assessment, while a high-frequency Endo cavitary probe (7.5 to 10 MHz) is used for transvaginal evaluation.

A probe cover must be used for the transvaginal approach. After each use, the probe should be appropriately disinfected as per institution protocols.

Preparation: If performing a transabdominal study, the patient should be asked to have a full bladder if possible as fluid-filled structures enhance the resolution of deeper structures on ultrasound as it aids in examining the uterus, placenta, and amniotic fluid. If a transvaginal ultrasound is deemed necessary, the patient should be asked to empty their bladder. Given the proximity of the intracavitary probe to the cervix, an empty bladder provides increased visualization of structures and improves patient comfort during the study.

The initial evaluation should commence by placing a curvilinear probe with the appropriately selected OB settings over the suprapubic area. The probe can be placed in either sagittal or transverse orientation. The probe indicator should be directed to the cephalad for the sagittal images and towards the patient's right side for transverse images. If a transvaginal examination is indicated, the patient should be placed in the lithotomy position. The probe should be inserted with the indicator in the vertical direction. Sagittal images are obtained by maintaining the indicator pointing towards the ceiling, while transverse imaging requires rotating the probe to have the indicator facing the patient's right side.

Several measurements are indicated for appropriate assessment of the status of the fetus and the maternal structures, starting with the estimation of the gestational age. Gestation dating by ultrasonography may be inaccurate during the third trimester.

Measurements of Fetal parts can be used in isolation or combined to estimate gestational age. Commonly used dating measurements include:

- Biparietal diameter (BPD)
- Occipitofrontal diameter (OFD)
- Head circumference (HC)
- Abdominal diameter (AD)
- Abdominal circumference (AC)
- Femur length (FL)

Recommended Textbooks:

OBSTETRICS ULTRASOUND: SECOND AND THIRD TRIMESTER by T.K. ZUBAIRI (Author)

3D Ultrasound in Prenatal Diagnosis:

A Practical Approach by Rabih Chaoui (Author)

Course Code: DMU 304

Course Title: Ultrasound Clinical Applications: Obstetrics & Gynaecology

Credits Hour: 03(3,0)

Course Objective:

Professional practice forms an integral part of this Obstetric Ultrasound module. This fact is demonstrated by the module design, which enables you to study theory whilst engaging in practice. This professional practice Obstetric Ultrasound module provides both a comprehensive and in-depth programme. There will be opportunities to develop evaluative, problem solving and critical thinking skills, as well as communication skills, to enable you to apply this knowledge to become a proficient practitioner in the field of obstetric ultrasound. You will be able to deliver a high-quality service to your clients. The syllabus for this module covers all aspects of obstetric ultrasound including early pregnancy assessments; first, second and third trimester scans; and relevant professional issues.

Content: The course syllabus covers: Applied anatomy, physiology and pathology related to the female reproductive system, menstrual cycle Embryological/Fetal development, including abnormal Fetal anatomy/developmental conditions Interpretation of biochemical, genetic, and other invasive or non-invasive screening/diagnostic tests Issues relating to the holistic preparation and care of the patient, Role of ultrasound in the overall management of the patient Range of ultrasound techniques for external and intra-cavity procedures; including transvaginal scanning, transabdominal scanning, Doppler studies (e.g., uterine, Fetal umbilical, middle cerebral arteries) and complementary and/or alternative imaging techniques.

Learning and Teaching On successful completion of this module, you will be able to:

Apply theoretical knowledge to the practice of Obstetric Ultrasound. Utilise relevant knowledge of anatomy, physiology, and pathology of the relevant organ systems to solve complex problems. Demonstrate a critical knowledge of the legal, ethical, and organisational aspects of current ultrasound practice in Obstetric Ultrasound. Critically evaluate contemporary research concerning the aetiology and management of pathologies affecting organ systems to inform practice and implement original approaches where appropriate. Critically evaluate the contribution that obstetric ultrasound makes, compared to other diagnostic tests/procedures, to derive a differential diagnosis. Perform a comprehensive range of obstetric ultrasound procedures both skilfully and safely, demonstrating the skills required of a competent practitioner, and an ability to adapt effectively to new or unusual situations Justify the contribution of the role of obstetric ultrasound to the overall management of the patient. Make evaluative judgements on the outcomes of ultrasound examination and report the findings accordingly. Make an active contribution within a multidisciplinary professional community by reflecting upon your own and others practice. Engage in effective communication with clients, their families and healthcare professionals, and make appropriate referrals as required.

Recommended Textbooks:

Practical Gynecological Ultrasound Jane Bates

Obstetric and Gynecological Ultrasound Made Easy Norman C. Smith, A. Pat M. Smith

Exam Preparation for Diagnostic Ultrasound Abdomen and OB/GYN Jann Delk, Nancy Smith

Miner, Oscar del Barco, Monica McCrea, Lisa M. B. Simons

Course Code: DMU 305
Course Title: Principles of Clinical Ultrasound
Credits Hour: 03(3,0)

Course Objective: Ultrasound has been an integral tool in evaluating pregnancies by obstetricians and radiologists for decades. With increasing accessibility of technology, the professionally trained providers involved in the care of pregnant patients have the ability to perform and interpret the following ultrasound examinations that provide immediate information to guide pregnancy care. These examinations will provide a foundation for clinical providers at the point of care to pursue more comprehensive.

Fetal evaluations “**Practice Parameter for the Performance of Limited**

Obstetric Ultrasound Examinations by Advanced Clinical Providers,” “Practice Parameter for the Performance of Standard Diagnostic Obstetric Ultrasound Examinations,” and “Obstetric and Gynecological Ultrasound Curriculum and Competency

Assessment in Residency Training Programs:

- Confirm intrauterine pregnancy.
- Identify the absence or presence of cardiac activity.
- Determine the gestational age of pregnancy.
- Visualize the Fetal position.
- Evaluate Fetal well-being.
- Assess Fetal growth.
- Evaluate amniotic fluid.

I. Equipment Learning Objectives: Be able to: Select the appropriate transducer for transabdominal and transvaginal examinations. Differentiate benefits and limitations to transabdominal and transvaginal techniques. Prepare, clean, and disinfect the transducer according to accepted guidelines. Follow appropriate prudent use and ALARA principles, including AIUM Official Statements

“**Recommended Maximum Scanning Times** for Displayed Thermal Index (TI) Values,” “Statement on Measurement of Fetal Heart Rate,” “Prudent Use in Pregnancy,” and “Keepsake Fetal Imaging.”

II. First Trimester Learning Objectives: Be able to:

- Identify the following anatomy by ultrasound:
 - Maternal:
 - Bladder
 - Uterus
 - Endometrium
 - Cervix
 - Adnexa and ovaries
 - Cul-de-sac
 - Pregnancy:
 - Gestational sac
 - Yolk sac
 - Embryo/fetus
 - Cardiac activity
 - Amnion
- Confirm an intrauterine pregnancy.

- Recognize the number of embryos/fetuses. Perform crown-rump length measurements for pregnancy dating.
- Measure embryo/Fetal cardiac activity with M-mode imaging.
- Recognize definitive diagnostic criteria for embryonic/Fetal death.
- Identify locations where free fluid would accumulate in the pelvis.

Second and Third Trimesters *Learning Objectives:* Be able to:

- Confirm the following:
 - Fetal number
 - Fetal lie/presentation
 - Fetal cardiac activity
 - Placental location and relation of placenta to the cervix
 - Amniotic fluid volume
- Identify the following maternal anatomy:
 - Bladder
 - Uterus-myometrium
 - Cervix
 - Adnexa and ovaries
- Identify the following Fetal anatomy:
 - Head anatomy needed (biometry):
 - Cranium
 - Falx
 - Thalamus
 - Cavum septum pellucidum
 - Cerebellum (not included in biparietal diameter)
 - Heart and chest

Abdomen:

- Stomach
- Umbilical vein (biometry)
- Extremities
- Evaluate amniotic fluid volume by measuring:
 - Amniotic fluid index
 - Maximum vertical pocket

Measure Fetal cardiac activity using M-mode imaging.

- Perform Fetal biometric measurements with appropriate landmarks and calliper placement:
 - Biparietal diameter
 - Head circumference
 - Abdominal circumference
 - Femur length
- Assess and score Fetal well-being with ultrasound components of the biophysical profile:
 - Fetal tone
 - Fetal movement
 - Fetal breathing
 - Amniotic fluid

Recommended Textbooks: Diagnostic Ultrasound: Principles and Instruments 5th Edition by Ph.D. Kremkau, Frederick W. (Author)

International Faculty from USA Medical Universities & Hospitals

Online Teaching, Training D.D.U Program from USA (Faculty/ Curriculum)

Who will teach their own specialty Subjects are 15-20 years' experience.

Prof. Dr. NAUSHABA BUTT,

M.B.B.S (PK), MCPS (Radiology), PGD Ultrasound (Vienna, Austria), ARDMS (USA) M.D (USA) West Coast Ultrasound Institute, 7951 Lyndora Street Downey, Ca 90242 USA

Abdomen/ OBGYN "A Specialist Teaching". /Clinical.

Prof Dr. TASNEEM HUSSAIN

M.B., B.S (PK), RDMS (AB, OB/GYN, BR), RVT, M.D (USA)
St. Luke's University Health Network- 2400 MAPLEWOOD AVENUE, BETHLEHEM PA

Breast/ Vascular /OB GYN Specialty Clinical

Prof Dr. JEAN YVES SEWAH

M.D (USA) RVT, ARDMS (USA)
Modern Tech College North Hollywood California, 11428 Fenton Ave, Lakeview Terrace, CA

Abdomen/ Vascular "US Specialist Teaching". /Clinical.

Prof. Dr. SYED SALEEM

M.D (USA), RVS, ARDMS, RVT, RCS
West Coast Ultrasound Institute Beverly Hills/ Los Angeles, California, USA

Echo cardio/ Vascular "US Specialist Teaching". /Clinical.

Prof.Dr ROBERT MONACO

MD, MPH, RMSK, Registered Musculoskeletal, Clinical Professor
Rutgers, New Jersey Medical School (UMDNJ) Newark, New Jersey, USA

Prof. Dr. ROZINA BADAL MUNIR (Leader of the Team)

MBBS (PK) DABRM, RPVI, RVT, MSK pocus, RDMS (USA), M.D (USA)
Darrow Stem cells Institute, Los Angeles California 9662 Glenbrook St. Cypress, CA,
Abdomen / Vascular "US Specialist Teaching". /Clinical.

Dr MUHAMMAD HAROON SAYLAB

M.D, MBA (Health Management), B.S(Associate) CVT, RDCS
Echocardiography, Vascular Technology

Prof.Dr. ASHRAF A. KHAN,

MD, MPH, MBA, FACE Infection Prevention Control Clinical Risk Management
CDC, TJC, CMS, DOH, WHO, OSHA, CAP, EPA, FDA, DNV
Health Care Epidemiologist, LEE Health System Fort Myers, Florida (USA)

(Associate) Prof Dr. FOZIA ANWAR

BDS, MS, PHD (Malaysia) Research Supervisor
Downstate Medical Centre, Brooklyn, New York

Prof. Dr. AURIF A. ABIDI

MBBCh, M.D, AMERICAN DIPLOMATE IN MEDICAL IMAGING,
University of Houston, Texas

After Completion PGD (D.D.U) 12 months, course work

(One thousand unaided Cases) in one specialty

Clinical Competence: Clinical Competence is designed to assess the overall clinical ultrasound competence of the DDU candidate in the workplace/clinical setting and includes assessment of a wide range of required knowledge, skills and abilities as defined by the relevant specialty syllabus for Candidates must familiarize themselves with the specific learning objectives, required abilities and major topic.

Assessment: Clinical Competence is achieved via a variety of techniques to enable an accurate assessment of the candidate's overall clinical ultrasound competence. The assessment methods used offer a balance between adequate assessment of knowledge, skills and abilities, and practicality and feasibility.

To assess Clinical Competence the following assessments will be used:

- i. Two (2) formative Case Studies (first year)
- ii. Two (2) formative Clinical Supervisor Assessments (first year)
- iii. Three (3) summative Case Studies (second year)
- iv. Three (3) summative Clinical Supervisor Assessments (second year)
- v. A Logbook with specified numbers and types of scans to be completed.
- vi. The completion of two (2) years diagnostic ultrasound experience

Logbook Requirements: All studies should be undertaken with appropriate supervision by the approved Primary Clinical Supervisor. The Primary Clinical Supervisor may delegate supervision to the approved Associate Clinical Supervisor where appropriate.

DMU(O&G) Examination	Minimum Requirements (Scans Performed)
Obstetrics (scans performed and supervised) =Total 500	
First (first) Trimester (11-14 weeks)	100
Second (second) Trimester	200
Third (third) Trimester	200
Early Pregnancy and Gynaecology =Total 500	
Early Pregnancy	200
Gynaecology	300
Total	1000

Advanced Ultrasound Practice

Learning Objectives: To successfully complete the DMU (O&G) candidates are expected to be able to demonstrate, in relation to the list of major clinical areas as listed under “**Major Topics**”, the following:

Ability to obtain a detailed, relevant clinical history.

- Ability to conduct the ultrasound examination in an appropriately effective manner taking into consideration the environment, and the patient’s privacy, cultural and religious needs.
- Understanding of, and skills involved in, producing, and recognizing an accurate and valid ultrasound examination and resultant data, including normal ranges of standard measurements and measurement protocols.
- Detailed knowledge of relevant anatomy, physiology, and pathology.
- Ability to determine the need for further information such as: extension of the ultrasound examination; other tests; further clinical information; follow-up examinations.
- Competence in the recognition of Sonographic appearances and relevant information including normal anatomy; normal variants; artifacts; abnormalities.
- Competence in determining appropriate provisional diagnosis/diagnoses as a result of the ultrasound examination and in conjunction with other available clinical information as relevant.
- Appreciation of the more rarely seen/uncommon pathologies which may be associated with an organ or organ system.
- Ability to perform and/or be able to interpret advanced ultrasound techniques such as 3D ultrasound as and when required to aid in the diagnosis.
- Recognition of any limitations of the ultrasound examination, including technical limitations, and the effect of these on diagnosis and clinical management.
- Ability to prepare a detailed report including information on findings/diagnoses, any limitations of the examination, correlation of findings with other relevant information, requirements/suggestions for further testing or follow-up examinations.
- Ability to be able to communicate effectively with the patient/client and/or their accompanying persons in a manner that is timely, relevant, and appropriate to the circumstances, where required.
- Ability to identify and act appropriately to ensure timely medical review/intervention where an urgent finding is made.

For Registration Regulatory Health Authority. MBBS & B.S Allied Health (16 years)

Diploma One Year Course Work MBBS Registration(PM&DC) Act 2011 (a.) Level-II (a)

12-month Diploma (b) Level-II(b) 24 months. (Clinical)one thousand cases.

Post Graduate Diploma in Diagnostic Ultrasound (D.D.U)

01-year course work + 1000 clinical cases

Health Services Academy affiliated Hospitals, Medical Centre, Under the supervision of consultant ,logbook must be complete with one year, award clinical Certificate.

- Diploma in Adult Echo-cardiography (course wk.+1000 Clinical cases
- Diploma in Neonatal 01-year course wk.+1000 Clinical cases
- Diploma in Paediatrics 01-year course wk.+1000 Clinical cases
- Diploma in Musculoskeletal, 01-year course wk.+1000 Clinical cases
- Diploma in Beast, Small Parts, 01-year course wk.+1000 Clinical cases
- Diploma in Cardiovascular Technology, 01-year course wk.+1000 Clinical cases
- Diploma in Vascular Technology, 01-year course wk.+1000 Clinical cases

Certificate Subspecialty, (Paid Residency) (02 days course work , 04 days Clinical Rotation)

- Certificate in Adult Echo-cardiography
- Certificate in Neonatal
- Certificate in Paediatrics
- Certificate in Musculoskeletal
- Certificate in Beast, Small Parts
- Certificate in Cardiovascular Technology
- Certificate in Vascular Technology

B.S (Allied Health) As per rules of Allied Health Professional Council Act 2022 (5th March) for registration to private practice required “Diploma (2 years / 04- semester Program).in clinical subjects.

Leading to BS (4 Years Program). MS (24 months course work + 6 months Thesis) and PhD (18 months advance subject course work in relevant Program 3 years Research work).

“**Diploma**” must be 2 year / 4 semesters. In clinical subject’s, Basic qualification to enter in any Diploma in clinical Program required must F. Sc 50% marks or Higher Secondary Certificate (12 years of studies course work) A- Level for international students.

Fellowship: Must be 2 years /04 Semester Clinical subject with hospital or University Diagnostic Centre required training in relevant Subjects.

Any” **Professional Certificate**” Allied Health Professional Council (AHP) under act 2022 required for registration at least 12 -months course work as technician. Less than 12 months course work certificate or diploma cannot work as technician in health care facility cannot registered with health care regulatory authority (Relevant Council

Post Graduate Diploma in DIAGNOSTIC ULTRASOUND (D.D.U)

Clinical Training, Lab, Practicum

DMC 100: Introduction to Clinical Practicum

1 Credit (1)

Introduction to working in the medical environment. Includes preparation for clinical internship and observation hours in the ultrasound department. Restricted to: DMC majors.

DMC 101: Introduction Sonography/Patient Care

2 Credits (2)

Introduction to the careers in sonography, terminology, medical ethics, scanning planes, applications of ultrasound, professional standards, and patient care. May be repeated up to 02 credits. Restricted to: DMC majors.

DMC 116: Vascular Technology I

2 Credits (2)

Review of basic ultrasound physics and principles, peripheral vascular anatomy, hemodynamic, Doppler evaluation, peripheral vascular scanning techniques, physiologic testing and the carotid arteries and the peripheral vascular system.

Restricted to: DMC majors.

DMC 116 L: Vascular Technology I Lab

1 Credit (2P)

Includes protocol development, scanning techniques, recognition of anatomical relationships and the normal ultrasound appearance of the carotid arteries and peripheral vasculature utilizing real-time Sonographic equipment including Doppler.

Restricted to: DMC majors.

DMC 130: Pelvic Sonography

1 Credit (1)

Includes the anatomy, sectional anatomy, and normal physiology of the pelvic structures, including the uterus, ovaries, prostate, pelvic muscles, lower GI, appendix, and vessels as well as scanning techniques, Sonographic appearance, and Doppler evaluation of the pelvis.

Restricted to: DMC majors.

DMC 130 L: Pelvic Sonography Lab

1 Credit (2P)

Includes protocol development, scanning techniques, recognition of anatomical relationships and the normal ultrasound appearance of the pelvic structures including the uterus, ovaries, prostate, lower gastrointestinal system, appendix, and pelvic muscles utilizing real-time Sonographic equipment including Doppler. Restricted to: DMC majors.

DMC 140: Abdominal Sonography
03 Credits (3)

Includes the anatomy, sectional anatomy and normal physiology of prevertebral vessels, liver, Biliary system, pancreas, upper gastrointestinal system, kidneys, adrenals, and spleen as well as scanning techniques, Sonographic appearance, and Doppler evaluation of the deep abdominal organs. Restricted to: DMC majors.

DMC 140 L: Abdominal Sonography Lab
01 Credit (4P)

Includes protocol development, scanning techniques, recognition of anatomical relationships and the normal ultrasound appearance of prevertebral vessels, liver, biliary system, pancreas, upper gastrointestinal system, kidneys and spleen utilizing real-time Sonographic equipment including Doppler. Restricted to: DMC majors.

DMC 150: Sonographic Principles and Instrumentation I
01 Credit (1)

Includes the fundamental properties and mathematical relationships between variables of wave parameters, acoustic variables, attenuation, pulsed wave operation, transducers, system operation, Doppler, and artifacts utilizing real-time Sonographic equipment. Restricted to: DMC majors.

DMC 160: 1st Trimester Obstetric Sonography
01 Credit (1)

Includes the embryology, anatomy, sectional anatomy, normal physiology, biometrics, assessment, and Sonographic appearance of the 1st trimester fetus, placenta, uterus and adnexa as well as scanning techniques according to recognized protocols. Restricted to: DMC majors.

DMC 165: Second/3rd Trimester Obstetric Sonography
01 Credit (1)

Includes the anatomy, sectional anatomy, normal physiology, biometrics, assessment, and Sonographic appearance of the 2nd and 3rd trimester fetus, placenta, uterus, and adnexa as well as scanning techniques according to recognized protocols. Restricted to: DMC majors.

DMC 170: Clinical Practicum I
02 Credits (8-10P)

Development of technical and professional aspects of diagnostic ultrasound in a hospital or clinical setting at the developmental level. Ongoing reinforcement and broadening of knowledge base related to hospital procedures and policies. Continued observation, assistance and performance of patient care and Sonographic duties under direct supervision. Restricted to: DMC majors.

DMC 180: Clinical Practicum II

05 Credits (30P)

Development of technical and professional aspects of diagnostic ultrasound in a hospital or clinical setting at the beginner level. Ongoing reinforcement and broadening of knowledge base related to hospital procedures and policies. Continue observation, assistance and performance of patient care and Sonographic duties under direct supervision. Restricted to: DMC majors.

DMC 201: Applied Sonographic Procedures**01 Credit (8P)**

Advances scanning skills, system optimization, anatomic recognition of abdominal and pelvic structures utilizing real-time Sonographic equipment including Doppler. Includes Sonographic evaluation of the first trimester pregnancy and normal fetus. Restricted to: DMS majors.

DMC 216: Vascular Technology II**02 Credits (2)**

Includes the pathology and pathophysiology of the vascular system, scanning techniques, clinical presentation, ultrasound appearance and Doppler evaluation seen with pathological conditions of the carotid arteries, deep and peripheral vascular systems. Restricted to: DMC majors.

DMC 216 L: Vascular Technology II Lab**01 Credit (2 P)**

Includes progressive development of skills following recognized protocols, scanning techniques, recognition of anatomical relationships with differentiation of normal and abnormal ultrasound appearance of the carotid arteries, deep and peripheral vascular systems utilizing real-time Sonographic equipment including Doppler. Restricted to: DMC majors.

DMC 226: Sonographic Case Studies I**01 Credit (1)**

Includes integration of didactic knowledge, clinical presentation, laboratory values, Sonographic appearance, and related medical imaging of a variety of pathological conditions through a variety of case analysis and presentations. Restricted to: DMC majors.

DMC 227: Sonographic Case Studies II**01 Credit (1)**

Continuation of DMS 226, integration of didactic knowledge, clinical presentation, laboratory values, Sonographic appearance and related medical imaging of a variety of pathological conditions through a variety of case analysis and presentations. Restricted to: DMC majors.

DMC 230: Gynaecologic Pathology

02 Credits (2)

Includes the pathology, pathophysiology of the female reproductive system, scanning techniques, clinical presentation, ultrasound appearance and Doppler evaluation seen with pathological conditions of the uterus, ovaries, and adnexa. Restricted to: DMC majors.

DMC 240: Abdominal Pathology I**02 Credits (2)**

Includes the pathology and pathophysiology of abdominal structures of the pre-vertebral vessels, liver, Biliary system, pancreas, spleen and gastrointestinal system, scanning techniques, ultrasound appearance, clinical presentation and Doppler evaluation seen with pathological conditions. Restricted to: DMC majors.

DMC 245: Abdominal Pathology II**02 Credits (2)**

Includes the pathology and pathophysiology of abdominal structures of the genitourinary system, spleen, retro peritoneum, adrenal glands, abdominal wall and prostate, scanning techniques, ultrasound appearance, clinical presentation and Doppler evaluation seen with pathological conditions. Restricted to: DMS majors.

DMC 248: Paediatric Sonography**02 Credits (2)**

Includes the anatomy of the brain, skull, spine, hips, and normal developmental changes as well as pathology and pathophysiology of specific conditions that affect the premature infant, newborn, and paediatric population across a variety of body systems. Restricted to: DMS majors.

DMC 250**Sonographic Principles and Instrumentation II****03 Credits (3)**

Includes properties of sound and its use in diagnostic imaging, artifacts, system operation, Doppler, basic hemodynamic, image optimization, bio effects, quality assurance, and modern technologies in ultrasound imaging. Restricted to: DMC majors.

DMC 255. Vascular Physics**02 Credits (2)**

Includes a review of sound properties and its use in diagnostic imaging, artifacts, system operation, Doppler, image optimization, bio effects, quality assurance, and in-depth application of fluid properties and Haemodynamics in vascular ultrasound imaging. Restricted to: DMC majors.

DMC 260: High Risk Obstetric Sonography**03 Credits (3)**

Includes congenital malformations of the developing fetus, high risk pregnancies, multiple gestation, maternal conditions and invasive procedures. Restricted to: DMS majors.

DMC 270: Clinical Practicum III
05 Credits (20P)

Continued development of technical and professional aspects of diagnostic ultrasound in a hospital or clinical setting at an intermediate level. Ongoing reinforcement and broadening of knowledge base related to hospital procedures and policies. Continued observation, assistance and performance of patient care and Sonographic duties under limited supervision. Restricted to: DMC majors.

DMC 280: Clinical Practicum IV
05 Credits (20P)

Application of technical and professional aspects of diagnostic ultrasound in a hospital or clinical setting at a proficient level. Ongoing reinforcement and broadening of knowledge base related to hospital procedures and policies. Continued observation, assistance and performance of patient care and Sonographic duties under limited supervision. Restricted to: DMC majors.

DMC 290: Small Parts & Superficial Structures
02 Credits (2)

Includes anatomy, pathology and pathophysiology, protocol development, scanning techniques, recognition of anatomical structures and the normal and pathological ultrasound appearance of the breast, thyroid, neck, scrotum, non-cardiac chest and musculoskeletal ultrasound. Restricted to: DMC majors.

DMC 291: Registry Preparation: OB/GYN
01 Credit (1)

Registry preparation mock examinations over materials covered in Obstetric and Gynecological ultrasound. Students must pass this course with a 74% or better OR pass national certification in OB/GYN Sonography. Restricted to: DMC majors.

DMC 292: Registry Preparation: Abdomen
01 Credit (1)

Registry preparation mock examinations over materials covered in abdominal ultrasound including small parts and superficial structures. Students must pass this course with a 74% or better OR pass ARDMS national certification exam in Abdominal Sonography. Restricted to: DMC majors.

DMC 293:
Registry Preparation: Vascular

01 Credit (1) Registry preparation mock examinations over materials covered in vascular ultrasound. Students must pass this course with a 74% or better OR pass national certification in Vascular Technology. Restricted to: DMC majors.

Proposal for Health Services Academy (online) Plan in ultrasound (2023-25) Diploma/Certificate

- Diploma in Diagnostic Ultrasound (D.D.U): Eligibility MBBS & Similar Foreign Degree, Duration 1 Year)
- Diploma in Echocardiography (Eligibility – MBBS, Duration – 1 Year)
- Diploma in Emergency Medicine (Eligibility: MBBS & Duration: 1 Year)
- Diploma in D.D.U Gynaecology & Obstetrics (12 Months)
- Diploma in Critical Care (12 Months)
- Diploma in D.D.U Abdomen (12 Months)
- Diploma in D.D.U Vascular (12 Months)
- Diploma in D.D.U Breast (12 Months)

Other Relevant Professional Diploma

- Diploma in Electronic Health Record System (12 Months)
- Diploma in Evidence Base Medicine (12 Months)
- Diploma in Medical Imaging (12 Months)
- Diploma in Cardiovascular (Eligibility- MBBS with 2 years' experience. Duration 12 Months)
- Diploma in Neuro Diagnostic (Eligibility- MBBS /2 years' experience. Duration 12 Months)
- Diploma in Health Informatics (12 Months)

Professional Certificate

- *Certificate Sexual and Reproductive Health (e-SRH) (12 Months)*
- *Certificate in Echocardiography & lung ultrasound (12 Months)*
- *Certificate in Pain Management (12 Month)*
- *Certificate Acute Medicine (12 Months)*
- *Certificate in Diabetes Management (6 Months)*
- *Certificate in DMU Gynaecology & Obstetrics (12 Months)*

Online Training Program

- Online Training Classes about Ultrasound Physics & Machine Setting (15 Classes)
- Online Training of Gynecological Sonography (infertility included) (18 Classes)
- Online Training of Abdominal ultra-Sonography (39 classes)
- Online Training of Early Pregnancy (Ectopic, level-1 Included) (16 Classes)
- Online Training of Detailed Fetal Sonography (31 Classes)
- Online Training of Fetal Colour Doppler (21 Classes)
- Online Training of Kidney Prostate Bladder (KUB) (9 Classes)
- Online Training of Small Parts (Thyroid & scrotum) (10 Classes)



PAKISTAN MEDICAL & DENTAL COUNCIL

REGULATIONS FOR THE APPOINTMENT/PROMOTIONS OF FACULTY/TEACHING STAFF/EXAMINERS/ PRINCIPALS /DEANS/VICE CHANCELLORS

IN UNDERGRADUATE & POSTGRADUATE MEDICAL & DENTAL INSTITUTIONS/ MEDICAL UNIVERSITIES OF PAKISTAN 2018

Certified that these Regulations have been framed by the Pakistan Medical & Dental Council in exercise of powers conferred under the Section 33 (2) of the Pakistan Medical & Dental Council Ordinance, 1962 and supersedes all previous regulations on the subject. These regulations shall come into force at once and shall be applicable on fresh appointments and next promotions in all medical and dental institutions recognised in Pakistan under the PM&DC Ordinance 1962. All appointments already made as per PREVIOUS PM&DC regulations shall not be disturbed and titles already accrued shall hold. However, all future appointments and promotions shall be made according to these regulations.

President Pakistan Medical & Dental Council
G-10/4, Mauve Area,
Islamabad.

Section-I

INTRODUCTION:

1-Short title and commencement. : (1) These regulations have been framed by the Council in exercise of powers contained in Section 33(2) (d) of the PM&DC Ordinance 1962 and may be called the Pakistan Regulations for the Appointment of Faculty/Teachers/Examiners/ Principals /Deans /Vice chancellors in Undergraduate & Postgraduate Medical & Dental Institutions and Medical Universities 2018 and lay down the binding criteria for appointments and promotions and grant of teaching experience for all medical and dental institutions recognized under the PM&DC Ordinance 1962.

(2) These regulations are not for registration of qualifications but for eligibility for appointments and promotions of Faculty/ Teachers/ Examiners/ Principals/ Deans/ Vice Chancellors in Undergraduate & Postgraduate Medical & Dental Institutions

(3) These shall come into force at once. All the previous regulations and amendments/decisions made by Council/Executive Committee pertaining to recognition of teaching experience shall stand repealed.

2- Definitions.

a. Teaching staff means Lecturer/Demonstrator, Senior Lecturer/Demonstrator, Assistant Professors, Associate Professors and Professors appointed as per these regulations.

b. "Standing Recognition Committee" (SRC) Medical & SRC Dental of the Council shall recommend to the Council to approve qualifications, their equivalence and experience.

(1) The words and expressions used but not defined herein shall have the same meaning as are assigned to them under the Ordinance or in other regulations made by the Council.

Section-II

MINIMUM QUALIFICATIONS LEVEL REQUIRED FOR APPOINTMENT OF TEACHERS IN MEDICAL AND DENTAL INSTITUTIONS

Learning Levels	Duration	Clinical Medical /Dental Qualifications	Basic Medical/Dental Sciences Qualifications
Level – I	MBBS 5 years BDS 4 years	MBBS/BDS	
Level – II a	Minimum 01 year after Level-I	Postgraduate Diplomas	M.Sc. Basic Sciences, Diploma in Medical Education, DMJ (1 year), DHPE
Level – II b	Minimum 02 years after Level-I	MCPS/M.Sc. or other 2 years duration diploma and equivalent qualifications with other nomenclatures	and equivalent qualifications with other nomenclatures MPH, MSPH/MHPE, DMJ (2 years), M.Phil. and equivalent qualifications with other nomenclatures.
Level – III	Minimum 3 or more years after Level-I	MD/MS/MDS/FCPS/ and equivalent qualifications with other nomenclatures	FCPS/PhD/ and equivalent qualifications with other nomenclature
Level – IV	Minimum 2 years of recognized. PG Qualification in related field after Level-III	Sub-Specialty Qualifications in relevant field	Sub-Specialty Qualifications in relevant field

1. Other nomenclatures / qualifications to be decided by SRC Medical or SRC Dental, as the case may be.

2. Holders of M.Phil. and other Level-II b qualifications in basic medical / dental sciences will be eligible to become Professor till 31 Dec 2020.

3. PhD in clinical sciences shall not be accepted as a qualification for appointment as teachers in clinical subject. MBBS/BDS graduates having **PhD** in basic subject with at least one year course work will continue to be appointed / promoted further .However, MBBS/BDS graduates having PhD (basic science subject) with research work only i.e., without course work, shall not be appointed as teachers in Medical/Dental colleges without acquiring additional level II-b qualification with course work in same subject. Graduates having PhD with research only may be appointed faculty as researchers in medical universities only subject to approval by SRC.

4* Holders of Level III qualification in Surgery and Allied subjects are eligible for appointment and promotion up to professor after attaining requisite teaching experience in the respective basic medical sciences prescribed in these regulations i.e. in anatomy Similarly level-III qualification holders of Medicine and Allied are eligible for appointment and promotion up to professor after attaining requisite teaching experience in the respective basic medical sciences subject prescribed in these regulations i.e. Biochemistry, Physiology and Pharmacology They will relinquish their original specialty position on joining basic sciences faculty. All such posts shall be advertised with public announcement that due to non- availability of faculty in respective basic science subjects the posts are being filled with the clinical subject qualification holder.

This provision shall be applicable only till 31st December 2023. Not more than 50% of faculty of any basic sciences department will be from the qualification holders of clinical subjects at any time.

5. No online / distant learning(degree) will be accepted for teaching of Clinical subjects. In cases of basic science subjects and medical education the council shall decide on case-to-case basis, on the recommendations of SRC Medical and Dental, respectively.

6. Teaching Experience acquired as Demonstrator / Lecturer before attaining Level II-b qualification in all basic subjects (medical / dental) will be granted in ratio of 4:1 (maximum two and half years as Asst. Prof) and after acquisition of Level II-b as 2:1 as equivalent to Assistant Professor.

Training period of Level-II b / III qualification will be counted as teaching experience in ratio 4:1. Teaching benefit will be granted for minimum duration of training prescribed for the qualification. This experience will be counted equal to lecturer / demonstrator as prerequisite for appointment as Assistant Professor.

7. Qualification less than 2 years but more than 1 year duration in any field / specialty after level-I qualification will be classified as level-II a.
8. Faculty member having requisite qualification in Medical Education i.e. MHPE / PhD and wants to join Department of Medical Education as faculty will start his/her carrier as Assistant Professor of Medical Education and teaching experience gained by him/her as faculty member of Clinical or Basic Medical Sciences subjects shall be given 4:1 and 2:1 teaching experience for MHPE and PhD respectively provided they have been actively involved in the medical education activities certified by the Principal/Dean of the institution or Vice Chancellor of a University.

Advertisement



Ministry of National Health
Services Regulations & Coordination
GOVERNMENT OF PAKISTAN



Health Services Academy (HSA)



Health Service Academy (HSA) is a health-oriented teaching, training, and research institute. A Degree Awarding Institute (DAI) chartered by Federal Government under HSA (Restructure) Act 2018 is delegated to improve quality of health education in the country enhance diagnosis in health care. Now introducing two (online) programs with theoretical and practicum clinical diagnostics, by international health care provider at cost effective rate for the patients.

ADMISSION OPEN

Health Services Academy (HSA) is offering following programmes admission by international faculty (USA).

1. Diploma in Diagnostics Ultrasound (D.D.U)

Admission Requirements: Medical Graduates (MBBS) and relevant

Duration Course: 12 months (32-36 Credits Hour) 02- semester with Clinical Practicum

Evening Program: 04 days in a week

2. Diploma in Diagnostics Medical Sonography (D.M.S)

Admission Requirements: F. Sc / Higher Secondary School Certificate with pre-medical Subjects & Pre- Engineering (Mathematics / Physics /Statistics). 50% Marks

Duration Course: 24 months (68 Credit Hours) 04- semester with clinical practicum

Evening Program: 04 days in a week

Candidate are required to apply online, No hard copy will entertain.

- Further information available on website: www.hsa.edu.pk
- Fill out the online application form carefully, after submission you will receive an automated email.

After Completing D.D.U & D.M.S are eligible to appears USA licensure examination which worldwide recognizes. American Registry Diagnostic Medical Sonography (ARDMS)

Physician Only Certification

RMSK® Registered in Musculoskeletal® sonography,

RPVI® Registered Physician in Vascular Interpretation®

CBCCT™ Certification Board of Cardiovascular Computed Tomography™

CBCMR Certification Board of Cardiovascular Magnetic Resonance

CBNC™ Certification Board of Nuclear Cardiology™

ABVM American Board of Vascular Medicine Examination & Endovascular Medicine Examination

Sonographer Certification

RDMS® Registered Diagnostic Medical Sonographer

RDCS® Registered Diagnostic Cardiac Sonographer

RVT ® Registered Vascular Technology Cardiac Sonographer

For further information please contact: Registrar, Health Services Academy, PM Health Complex, Park Road, Chak Shahzad, Islamabad Ph: 051-9255590-5 Ext- 106 Fax 051-9255591,
Cell: 0334 500 6138 , drshafaat@gmail.com Website: www.hsa.edu.pk Email: admissions@hsa.edu.pk