SYLLABUS AND CURRICULUM OF DIPLOMA IN ULTRASOUND & SONOGRAPHY COURSE

DIPLOMA IN ULTRASOUND & SONOGRAPHY

The **Diploma in Ultrasound & Sonography** is a Allied health care program designed to train students in **ultrasound imaging techniques**, operation of ultrasound machines, and basic interpretation of images under medical supervision.
This course prepares students to work as **Ultrasound / Sonography Assistants** in hospitals and diagnostic centers.

Course Overview

- **Full Form**: **DIPLOMA IN ULTRASOUND & SONOGRAPHY**
- **Duration**: 2 Years + 6 Months (Internship)
- **Eligibility**:
    - On the basis of 10th (Only Certificate Courses)
    - On the basis of 12th (Only Diploma Courses)
    - On the basis of B.Sc. (Only PG Diploma Course)

Career Opportunities after Ultrasound & Sonography

- **Ultrasound Technician (Assistant Level)**
- **Sonography Assistant**
- **Radiology Assistant**
- **Diagnostic Imaging Technician Assistant**
- **Hospital Imaging Department Staff**

SEMESTER – I

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DUS101	ANATOMY & PHYSIOLOGY OF THE REPRODUCTIVE SYSTEM	45 Min	1 Hrs.	50	50
DUS102	INTRODUCTION TO ULTRASOUND TECHNOLOGY	45 Min	1 Hrs.	50	50
DUS103	BASICS OF SONOGRAPHIC PROCEDURES	45 Min	1 Hrs.	50	50
DUS104	FUNDAMENTALS OF PATHOLOGY & MICROBIOLOGY	45 Min	1 Hrs.	50	50

ANATOMY & PHYSIOLOGY OF THE REPRODUCTIVE SYSTEM

Theory

UNIT 1 – Introduction to Reproductive System

- Definition and functions of reproductive system
- Male vs Female reproductive system overview
- Primary and secondary sexual characteristics
- Puberty and sexual maturation basics
- Importance of reproductive system knowledge in ultrasound

UNIT 2 – Male Reproductive System Anatomy

External Organs

- Penis – structure and function
- Scrotum – temperature regulation

Internal Organs

- Testes – structure, blood supply, function

- Epididymis – sperm storage and maturation
- Vas deferens
- Seminal vesicles
- Prostate gland
- Bulbourethral glands

Supporting Structures

- Spermatic cord
- Blood supply and nerve supply

UNIT 3 – Male Reproductive Physiology

- Spermatogenesis
- Sperm maturation and transport
- Hormonal regulation:
  - Testosterone
  - FSH
  - LH
- Semen formation
- Male fertility basics

UNIT 4 – Female Reproductive System Anatomy

External Genitalia (Vulva)

- Labia majora & minora
- Clitoris
- Vestibule

Internal Organs

- Vagina – structure and function
- Uterus – layers, position, supports
- Fallopian tubes – parts and function
- Ovaries – structure and follicle development

UNIT 5 – Female Reproductive Physiology

Ovarian Cycle

- Follicular phase
- Ovulation
- Luteal phase

Menstrual Cycle

- Hormonal regulation
- Endometrial changes
- Normal cycle phases

UNIT 6 – Hormonal Control of Reproduction

- Hypothalamus–Pituitary–Gonadal axis
- Estrogen
- Progesterone
- Testosterone
- Prolactin
- Hormonal feedback mechanisms

UNIT 7 – Fertilization & Early Pregnancy (Embryology)

- Gametogenesis (Spermatogenesis & Oogenesis)
- Fertilization process
- Zygote formation
- Implantation
- Placenta formation
- Early embryo development

UNIT 8 – Pregnancy Physiology

- Physiological changes in pregnancy
- Placental hormones
- Fetal growth basics
- Amniotic fluid basics

UNIT 9 – Sonographic Anatomy of Reproductive System

Female

- Uterus ultrasound anatomy
- Endometrium changes during cycle
- Ovary and follicle monitoring
- Early pregnancy ultrasound anatomy

Male

- Testicular ultrasound anatomy

- Prostate basics

UNIT 10 – Applied & Clinical Aspects

- Infertility overview
- PCOS basic concept
- Fibroid basic concept
- Ovarian cyst basic concept
- Ectopic pregnancy basics
- Congenital anomalies overview

Practical

➢ Identification of Reproductive Organs

❖ Male Reproductive System

- Identification of:
  - Testis
  - Epididymis
  - Vas deferens
  - Prostate gland
  - Seminal vesicles
  - Penis
  - Scrotum

❖ Female Reproductive System

- Identification of:
  - Uterus (Fundus, Body, Cervix)
  - Ovaries
  - Fallopian Tubes
  - Vagina
  - External genitalia

➢ Microscopic / Basic Physiology Understanding

- Basic histology slide demonstration:
  - Testis tissue
  - Ovary tissue
  - Uterus endometrium layers
- Understanding follicle development stages

➢ Ultrasound Machine Basic Handling

- Introduction to ultrasound machine parts
- Probe types (Convex, Linear, Transvaginal)
- Machine safety precautions
- Basic knobology (gain, depth – observation)

➢ Sonographic Anatomy Identification (Female)

❖ Pelvic Ultrasound

- Uterus position and size
- Endometrium thickness (cycle correlation – basic concept)
- Ovaries location and size
- Follicle identification (basic)

❖ Early Pregnancy Basics

- Gestational sac
- Yolk sac
- Fetal pole

➢ Sonographic Anatomy Identification (Male)

❖ Scrotal Ultrasound

- Testis shape and echotexture
- Epididymis basic identification
- Scrotal sac layers

❖ Prostate

- Basic prostate location understanding

➢ Patient Preparation & Positioning

- Patient privacy & consent basics
- Female pelvic scan preparation
- Male scrotal scan positioning basics
- Infection control & hygiene

➢ Normal Physiology Correlation with Imaging

- Menstrual cycle vs Endometrial changes
- Ovulation basic ultrasound concept
- Pregnancy physiological changes

INTRODUCTION TO ULTRASOUND TECHNOLOGY

Theory

UNIT 1 – Basics of Ultrasound Technology

- Definition of Ultrasound
- History and development of ultrasound imaging
- Role of ultrasound in modern medical diagnosis
- Advantages of ultrasound imaging
- Limitations of ultrasound

UNIT 2 – Basic Physics of Ultrasound

- Sound waves and properties
- Frequency, wavelength, velocity
- Amplitude and intensity
- Reflection, refraction, attenuation
- Acoustic impedance
- Echogenicity concept
- Image formation basic

UNIT 3 – Ultrasound Equipment & Machine Components

- Ultrasound machine overview
- Main parts:
  - Monitor / Display
  - Control panel
  - CPU system
  - Transducer
- Types of ultrasound machines:
  - Portable
  - Trolley based
  - Handheld

UNIT 4 – Transducers (Ultrasound Probes)

- Working principle of transducers
- Piezoelectric effect
- Types of probes:
  - Linear probe
  - Curvilinear probe
  - Phased array probe
  - Transvaginal probe (Introduction only)
- Probe selection basics

UNIT 5 – Ultrasound Imaging Modes

- A-Mode (Basic concept)
- B-Mode (Most common)
- M-Mode (Motion mode – heart basics)
- Doppler ultrasound (Introduction):
  - Color Doppler (Basic concept)
  - Spectral Doppler (Intro level)

UNIT 6 – Knobology

- Gain
- Depth
- Focus
- Time Gain Compensation (TGC)
- Freeze and Image Store
- Measurement tools basics

UNIT 7 – Image Quality & Optimization

- Resolution types:
  - Axial
  - Lateral
  - Temporal
- Artifacts basics:
  - Acoustic shadow
  - Enhancement
  - Reverberation
- Methods to improve image quality

UNIT 8 – Patient Preparation & Safety

- Patient identification
- Consent basics
- Patient positioning
- Infection control
- Probe cleaning & disinfection

UNIT 9 – Clinical Applications of Ultrasound

Basic Introduction

- Abdominal ultrasound
- Obstetrics ultrasound
- Gynecology ultrasound
- Small parts ultrasound
- Scrotal ultrasound
- Thyroid ultrasound (intro)

UNIT 10 – Documentation & Reporting Basics

- Image labeling
- Patient data entry
- Image storage
- Record maintenance

UNIT 11 – Quality Assurance & Equipment Care

- Daily machine check basics
- Probe care
- Machine calibration basics
- Electrical safety

Practical

➢ Ultrasound Machine Identification

- Monitor / Display screen
- Control panel
- Keyboard / trackball
- CPU system
- Probe ports
- Printer / Image storage system

➢ Ultrasound Transducer (Probe) Identification

❖ Identification and Basic Use

- Linear probe
- Curvilinear probe
- Phased array probe
- Transvaginal probe (Demonstration only)

❖ Probe Care

- Probe handling methods
- Gel application basics
- Cleaning and disinfection methods

➢ Basic Knobology (Machine Controls)

- Power ON / OFF
- Gain adjustment
- Depth adjustment
- Focus adjustment
- TGC (Time Gain Compensation) – basic concept
- Freeze / Store image
- Measurement tool demonstration

➢ Basic Ultrasound Scanning Demonstration

❖ Abdominal Scan

- Liver basic view
- Kidney basic view
- Urinary bladder basic view

❖ Pelvic Scan

- Uterus basic view
- Ovary basic view

➢ Patient Preparation & Positioning

- Patient identification process
- Consent basics
- Patient positioning basics:
    - Supine position

  - Lateral position
- Full bladder preparation (Pelvic scan)
- Patient comfort and privacy

➢ Infection Control & Safety

- Hand hygiene
- Probe cleaning and disinfection
- Biomedical waste disposal basics
- Electrical safety precautions

➢ Image Identification

- Liver
- Kidney
- Urinary bladder
- Uterus
- Ovary
- Testis

➢ Ultrasound Image Artifacts

- Acoustic shadow
- Posterior enhancement
- Reverberation artifact

BASICS OF SONOGRAPHIC PROCEDURES

Theory

UNIT 1 – Introduction to Sonographic Procedures

- Definition of sonographic procedure
- Role of ultrasound in diagnosis
- Role of sonography technician / assistant
- Scope and limitations of technician role
- Basic workflow in ultrasound department

UNIT 2 – Patient Preparation for Sonography

- Patient identification protocol
- Consent basics

- Patient history collection basics
- Preparation for different scans:
  - Fasting (Abdominal scan)
  - Full bladder (Pelvic scan)
  - Special preparation (if required)
- Patient counseling basics

UNIT 3 – Patient Positioning Techniques

- Supine position
- Lateral position
- Prone position (basic concept)
- Fowler's position (intro level)
- Positioning according to scan requirement

UNIT 4 – Standard Sonographic Scanning Planes

- Longitudinal plane
- Transverse plane
- Oblique plane
- Importance of correct plane selection

UNIT 5 – Basic Scanning Techniques

- Probe holding techniques
- Gel application techniques
- Probe pressure control
- Probe movement methods:
  - Sliding
  - Rocking
  - Tilting
  - Rotating

UNIT 6 – Abdominal Sonography Basic Procedures

- Liver scanning basics
- Gall bladder scanning basics
- Kidney scanning basics
- Urinary bladder scanning basics
- Pancreas (intro level)
- Spleen (intro level)

UNIT 7 – Pelvic Sonography Basic Procedures

Female Pelvis

- Uterus scanning basics
- Endometrium basic concept
- Ovary scanning basics

Male Pelvis

- Urinary bladder scanning basics
- Prostate introduction

UNIT 8 – Obstetric Sonography

- Pregnancy confirmation scan basics
- Gestational sac identification
- Fetal pole introduction
- Basic fetal viability concept

UNIT 9 – Small Parts Sonography

- Thyroid scanning basics
- Breast scanning basics (intro concept)
- Scrotal ultrasound basics

UNIT 10 – Infection Control & Safety in Sonography

- Hand hygiene
- Probe disinfection
- Cross infection prevention
- Biomedical waste disposal basics

UNIT 11 – Documentation & Image Recording

- Patient data entry basics
- Image labeling
- Measurement basics
- Image storage & backup

UNIT 12 – Quality Assurance in Sonography

- Machine check basics
- Probe quality check
- Image quality monitoring
- Error prevention basics

Practical

➢ Ultrasound Room & Equipment Preparation

- Preparation of ultrasound room
- Machine start-up and shutdown procedure
- Probe selection for different examinations
- Gel preparation and use

➢ Patient Reception & Preparation

- Patient identification and verification
- Consent confirmation
- History taking basics (as per referral)
- Patient preparation protocols:
    - Fasting for abdominal scan
    - Full bladder for pelvic scan

➢ Patient Positioning Techniques

- Supine position
- Right and left lateral positions
- Prone position
- Position adjustment during scanning

➢ Probe Handling & Scanning Techniques

- Correct probe holding methods
- Gel application techniques
- Probe movement:
    - Sliding
    - Rocking
    - Tilting
    - Rotation
- Pressure control during scanning

➢ Abdominal Sonography Procedures

- Liver scanning procedure
- Gall bladder scanning procedure
- Kidney scanning procedure
- Urinary bladder scanning procedure

➢ Pelvic Sonography Procedures (Basic Level)

Female Pelvis

- Uterus scanning procedure
- Ovary scanning procedure

Male Pelvis

- Urinary bladder scanning
- Prostate (observation only)

➢ Obstetric Sonography

- Pregnancy confirmation scan observation
- Gestational sac identification
- Fetal pole observation (intro level)

➢ Small Parts Sonography

- Thyroid scan observation
- Breast scan observation
- Scrotal ultrasound observation

➢ Image Optimization & Artifacts

- Gain adjustment
- Depth adjustment
- Focus selection
- Identification of common artifacts:
    - Shadow
    - Enhancement

➢ Image Recording & Documentation

- Image freeze and capture
- Image labeling
- Measurement basics
- Report file handling

➢ Infection Control & Safety

- Hand hygiene techniques
- Probe cleaning and disinfection
- Linen and waste disposal
- Electrical safety precautions

FUNDAMENTALS OF PATHOLOGY & MICROBIOLOGY

Theory

FUNDAMENTALS OF PATHOLOGY

UNIT 1 – Introduction to Pathology

- Definition of pathology
- Branches of pathology
- Role of pathology in diagnosis
- Correlation of pathology with radiology & ultrasound
- Basic terminology used in pathology

UNIT 2 – Cell Injury & Cell Death

- Normal cell structure (brief review)
- Causes of cell injury
- Reversible cell injury
- Irreversible cell injury
- Necrosis
- Apoptosis

UNIT 3 – Inflammation & Healing

- Definition and types of inflammation
- Acute inflammation

- Chronic inflammation
- Signs of inflammation
- Healing and repair
- Regeneration and fibrosis

UNIT 4 – Circulatory Disturbances

- Edema
- Congestion
- Thrombosis
- Embolism
- Infarction
- Shock (basic concept)

UNIT 5 – Growth Disorders & Neoplasia

- Atrophy
- Hypertrophy
- Hyperplasia
- Metaplasia
- Dysplasia
- Neoplasia – definition
- Benign and malignant tumors
- Differences between benign and malignant tumors

UNIT 6 – Hematological Disorders

- Anemia – types and causes
- Leukemia – basic concept
- Thrombocytopenia
- Basic blood investigations (overview)

UNIT 7 – Systemic Pathology (Ultrasound-Relevant)

Liver

- Fatty liver
- Hepatitis (intro)
- Cirrhosis (basic)

Gall Bladder

- Gallstones

- Cholecystitis (intro)

Kidney

- Renal calculi
- Hydronephrosis
- Renal cysts

Uterus & Ovary

- Fibroid uterus
- Ovarian cyst
- PCOS (intro)

Others

- Abscess (general concept)
- Cyst vs solid mass (basic difference)

FUNDAMENTALS OF MICROBIOLOGY

UNIT 8 – Introduction to Microbiology

- Definition of microbiology
- Classification of microorganisms
- Normal flora
- Pathogenic microorganisms
- Sources of infection

UNIT 9 – Bacteria

- Basic structure of bacteria
- Classification of bacteria
- Common bacterial infections
- Modes of transmission
- Sterilization and disinfection (intro)

UNIT 10 – Viruses

- Structure of viruses
- DNA and RNA viruses
- Common viral diseases:
    - Hepatitis
    - HIV (basic awareness)

  - Influenza
- Viral transmission basics

UNIT 11 – Fungi

- Basic structure of fungi
- Common fungal infections
- Opportunistic infections (intro)

UNIT 12 – Parasites

- Protozoa (intro)
- Helminths (intro)
- Modes of transmission
- Prevention methods

UNIT 13 – Infection Control & Hospital Hygiene

- Chain of infection
- Universal precautions
- Hand hygiene
- Personal protective equipment (PPE)
- Biomedical waste management

UNIT 14 – Laboratory Diagnosis

- Sample collection basics
- Transport of specimens
- Overview of laboratory tests
- Role of lab reports in imaging diagnosis

APPLIED ASPECTS FOR SONOGRAPHY

UNIT 15 – Pathology–Ultrasound Correlation

- Inflammatory lesions on ultrasound
- Cystic vs solid lesions
- Abscess vs tumor (basic idea)
- Infection related organ enlargement

UNIT 16 – Safety & Professional Awareness

- Infection risks in ultrasound department
- Probe contamination
- Cross infection prevention
- Ethical responsibilities of technician

Practical

PATHOLOGY PRACTICAL

➢ Identification of Pathological Specimens (Models / Charts / Images)

- Inflammation (acute vs chronic – chart level)
- Tumor (Benign vs Malignant – basic features)
- Cyst vs Solid lesion (diagram based)
- Abscess (basic concept image)

➢ Hematology Basic Demonstration (Observation)

- Blood smear slide demonstration (if available)
- Hemoglobin test (demonstration)
- Blood grouping basics (demo level only)

➢ Pathology–Ultrasound Correlation (Image Study)

Students should observe ultrasound images of:

- Fatty liver
- Liver abscess (basic awareness)
- Gall stones
- Renal stones
- Hydronephrosis
- Uterine fibroid
- Ovarian cyst

➢ Specimen Handling Awareness

- Sample labeling basics
- Transport of specimens (basic concept)
- Storage awareness (intro level)

MICROBIOLOGY PRACTICAL

➢ Basic Microbiology Lab Orientation

- Introduction to microbiology lab setup
- Lab safety rules
- Biosafety basics

➢ Identification of Microorganisms (Chart / Slide Level)

Students should observe:

- Bacteria (basic morphology)
- Virus (diagram level understanding)
- Fungi (basic structure)
- Parasites (intro level)

➢ Sterilization & Disinfection Demonstration

- Autoclave (demo)
- Chemical disinfection (intro level)
- Surface cleaning methods

➢ Infection Control Practices (Hospital Based)

- Hand washing technique
- PPE use (Gloves, Mask, Gown – demo)
- Biomedical waste segregation (color coding basics)

APPLIED PRACTICAL FOR SONOGRAPHY

➢ Infection Prevention in Ultrasound Department

- Probe cleaning and disinfection
- Gel contamination prevention
- Patient contact surface cleaning

SEMESTER – II

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DUS201	ULTRASOUND PHYSICS &	45 Min	1 Hrs.	50	50

	INSTRUMENTATION				
DUS202	GENERAL ABDOMEN ULTRASOUND & SONOGRAPHY	45 Min	1 Hrs.	50	50
DUS203	CLINICAL APPLICATIONS OF ABDOMINAL ULTRASOUND	45 Min	1 Hrs.	50	50
DUS204	OBSTETRICS, GYNECOLOGY & VASCULAR ULTRASOUND	45 Min	1 Hrs.	50	50

ULTRASOUND PHYSICS & INSTRUMENTATION

Theory

ULTRASOUND PHYSICS

UNIT 1 – Introduction to Ultrasound Physics

- Definition of sound and ultrasound
- History of ultrasound in medicine
- Uses of ultrasound in medical diagnosis
- Advantages and limitations of ultrasound

UNIT 2 – Basic Properties of Sound Waves

- Frequency
- Wavelength
- Period
- Amplitude
- Velocity of sound in tissues
- Acoustic power and intensity

UNIT 3 – Sound Wave Interactions with Tissue

- Reflection
- Refraction
- Scattering
- Absorption
- Attenuation
- Acoustic impedance

UNIT 4 – Pulse Echo Principle

- Pulse transmission
- Echo reception
- Time of flight principle
- Range equation (basic concept)

UNIT 5 – Ultrasound Beam Characteristics

- Beam formation
- Beam width
- Near field and far field
- Beam divergence
- Focusing techniques

UNIT 6 – Resolution in Ultrasound

- Axial resolution
- Lateral resolution
- Elevational resolution
- Temporal resolution
- Factors affecting resolution

UNIT 7 – Doppler Ultrasound Physics

- Doppler principle
- Doppler shift
- Continuous wave Doppler
- Pulsed wave Doppler
- Color Doppler basics

ULTRASOUND INSTRUMENTATION

UNIT 8 – Ultrasound Machine Components

- System unit
- Display system
- Control panel
- CPU and signal processor
- Data storage system

UNIT 9 – Transducers (Probes)

- Piezoelectric effect
- Types of transducers:

  - Linear
  - Curvilinear
  - Phased array
  - Endocavitary probes (intro)
- Probe frequency selection

UNIT 10 – Image Formation & Processing

- Echo signal processing
- Analog to digital conversion
- Gray scale imaging
- Dynamic range (basic concept)
- Image display

UNIT 11 – Ultrasound Imaging Modes

- A Mode
- B Mode
- M Mode
- Doppler Mode (Intro)

UNIT 12 – Machine Controls (Knobology – Theory Level)

- Gain
- Depth
- Focus
- TGC
- Dynamic range
- Persistence

UNIT 13 – Ultrasound Artifacts

- Acoustic shadow
- Posterior enhancement
- Reverberation
- Mirror image artifact
- Side lobe artifact

UNIT 14 – Bioeffects & Safety

- Thermal effect
- Mechanical effect
- ALARA principle
- Patient safety guidelines

UNIT 15 – Quality Assurance & Equipment Maintenance

- Machine performance checks
- Probe care and maintenance
- Preventive maintenance basics
- Calibration basics

APPLIED ULTRASOUND PHYSICS

UNIT 16 – Physics in Clinical Imaging

- Frequency vs penetration
- Resolution vs depth trade-off
- Probe selection for different organs

UNIT 17 – Basic Troubleshooting

- Poor image quality causes
- Noise and artifact troubleshooting
- Probe defect identification

Practical

➢ Ultrasound Machine Components Identification

- Monitor / Display
- Control panel
- Keyboard / Trackball
- CPU unit
- Probe connectors
- Image storage system

➢ Transducer (Probe) Study

Identification of Probe Types

- Linear probe
- Curvilinear probe
- Phased array probe
- Endocavitary probe

Probe Handling

- Correct probe holding
- Gel application technique
- Probe cleaning and disinfection

➢ Basic Knobology (Machine Control Practice)

- Power ON / OFF procedure
- Gain adjustment
- Depth adjustment
- Focus control
- TGC adjustment
- Freeze and store image
- Basic measurement tool use

➢ Image Formation Observation

- Real-time image formation
- Effect of gain on image brightness
- Effect of depth change
- Effect of focus change

➢ Resolution & Penetration Demonstration

- High frequency vs Low frequency comparison
- Depth vs image quality observation
- Resolution concept demonstration

➢ Ultrasound Beam Demonstration

- Beam focus demonstration (diagram / simulation)
- Near field and far field concept

➢ Doppler Demonstration

- Color Doppler demonstration
- Flow direction concept
- Basic Doppler display understanding

➢ Ultrasound Artifacts Identification

- Acoustic shadow

- Posterior enhancement
- Reverberation artifact
- Mirror image

➢ Quality Assurance & Equipment Care

- Daily machine check
- Probe cable inspection
- Probe surface inspection
- Cleaning protocol demonstration

➢ Safety & Bioeffects Awareness

- ALARA principle demonstration
- Thermal index / Mechanical index awareness
- Electrical safety precautions

GENERAL ABDOMEN ULTRASOUND & SONOGRAPHY

Theory

1. INTRODUCTION TO ABDOMINAL SONOGRAPHY

- Scope and importance of abdominal ultrasound
- Role of sonographer in diagnosis
- Indications & contraindications
- Patient preparation for abdominal scan
- Scan protocols and documentation
- Infection control and patient safety

2. ULTRASOUND PHYSICS RELATED TO ABDOMEN

- Basic ultrasound principles
- Probe selection (curvilinear, linear, phased array)
- Image optimization and knobology
- Doppler basics (Color, Spectral, Power Doppler)
- Artefacts in abdominal ultrasound

3. ABDOMINAL ANATOMY & CROSS-SECTIONAL ANATOMY

A. Solid Organs

- Liver anatomy and segments
- Spleen
- Pancreas
- Adrenal glands

B. Hollow Organs

- Gallbladder
- Biliary tree
- Gastrointestinal tract
- Urinary bladder

C. Vascular Structures

- Abdominal aorta
- IVC
- Portal venous system

4. SONOGRAPHIC TECHNIQUES & SCANNING PROTOCOLS

- Patient positioning
- Standard scan planes
- Organ measurement techniques
- FAST / E-FAST scanning basics
- Documentation and reporting

5. HEPATOBILIARY ULTRASOUND

Liver

- Normal liver ultrasound appearance
- Fatty liver
- Hepatitis
- Cirrhosis
- Liver masses (benign & malignant)
- Portal hypertension

Gallbladder & Biliary Tree

- Cholelithiasis
- Cholecystitis
- Biliary obstruction

- CBD dilatation

6. PANCREAS & RETROPERITONEUM

- Normal pancreas
- Pancreatitis
- Pancreatic tumors
- Retroperitoneal space
- Adrenal gland imaging

7. SPLENIC & LYMPHATIC SYSTEM

- Normal spleen
- Splenomegaly
- Splenic lesions
- Abdominal lymph nodes

8. URINARY TRACT ULTRASOUND

- Kidney anatomy and scanning
- Hydronephrosis
- Renal stones
- Renal cysts & tumors
- Urinary bladder pathology

9. GASTROINTESTINAL TRACT SONOGRAPHY

- Bowel wall imaging
- Appendicitis
- Intestinal obstruction
- Hernias
- Ascites and peritoneal fluid

10. ABDOMINAL VASCULAR ULTRASOUND

- Aorta scanning and aneurysm detection
- IVC evaluation
- Portal vein Doppler
- Hepatic vein Doppler
- Renal artery Doppler

11. EMERGENCY ABDOMINAL ULTRASOUND

- FAST / E-FAST protocol
- Trauma abdomen

- Acute abdomen evaluation

Practical

➢ ULTRASOUND MACHINE HANDLING & BASICS

- Machine start-up and shutdown procedure
- Transducer types and selection (Curvilinear, Linear, Phased Array)
- Knobology practice
  - Gain
  - Depth
  - Focus
  - TGC
  - Frequency adjustment
- Image optimization techniques
- Patient data entry and image storage

2. PATIENT PREPARATION & POSITIONING

- Fasting protocol demonstration
- Bladder filling instructions
- Infection control and probe cleaning
- Patient communication and consent
- Standard patient positions
  - Supine
  - Left lateral
  - Right lateral
  - Erect position

➢ NORMAL ABDOMINAL ORGAN SCANNING PRACTICE

❖ Liver

- Liver scanning in multiple planes
- Liver size measurement
- Segmental anatomy identification
- Portal vein visualization

❖ Gallbladder & Biliary Tree

- Gallbladder length and wall thickness measurement
- CBD measurement
- Intrahepatic biliary radicals visualization

❖ Pancreas

- Head, body, tail visualization
- Relation with splenic vein and SMA

❖ **Spleen**

- Spleen length measurement
- Splenic hilum identification

❖ **Kidneys**

- Kidney length measurement
- Cortico-medullary differentiation
- Pelvicalyceal system evaluation

❖ **Urinary Bladder**

- Bladder wall thickness
- Residual urine volume measurement

➢ **ABDOMINAL VASCULAR PRACTICAL**

- Abdominal aorta scanning
- IVC scanning
- Portal vein Doppler practice
- Hepatic vein Doppler basics
- Renal artery Doppler basics

➢ **GASTROINTESTINAL & PERITONEAL SCANNING**

- Bowel loop identification
- Appendix screening technique
- Ascites detection
- Peritoneal fluid localization

➢ **PATHOLOGY BASED PRACTICAL TRAINING**

❖ **Hepatobiliary**

- Fatty liver grading
- Cirrhosis appearance
- Liver cyst / mass detection
- Gallstones detection
- Cholecystitis features

❖ **Renal**

- Renal calculi detection
- Hydronephrosis grading
- Renal cyst identification
- Renal mass screening

❖ **Pancreas**

- Acute pancreatitis features
- Pancreatic enlargement detection

❖ **Spleen**

- Splenomegaly assessment
- Splenic lesion screening

➢ **EMERGENCY ABDOMEN PRACTICAL**

- FAST scan protocol
- Free fluid detection in trauma
- Acute abdomen screening

CLINICAL APPLICATIONS OF ABDOMINAL ULTRASOUND

Theory

1. INTRODUCTION TO CLINICAL ABDOMINAL ULTRASOUND

- Role of ultrasound in clinical diagnosis
- Advantages and limitations of abdominal ultrasound
- Indications and contraindications
- Patient preparation protocols
- Clinical history correlation with ultrasound findings
- Ethical and medico-legal aspects

2. CLINICAL ANATOMY & SONOGRAPHIC CORRELATION

- Surface anatomy vs ultrasound anatomy
- Cross-sectional abdominal anatomy
- Normal sonographic variants
- Age-related anatomical changes
- Post-surgical anatomical changes

3. HEPATOBILIARY CLINICAL APPLICATIONS

Liver

- Diffuse liver diseases
  - Fatty liver
  - Hepatitis
  - Cirrhosis
- Focal liver lesions
  - Cysts
  - Hemangioma
  - Liver abscess
  - Primary tumors
  - Metastasis
- Portal hypertension evaluation
- Liver trauma assessment

Gallbladder & Biliary System

- Gallstones and sludge
- Acute and chronic cholecystitis
- Biliary obstruction
- Choledocholithiasis
- Obstructive jaundice evaluation

4. PANCREATIC CLINICAL APPLICATIONS

- Acute pancreatitis diagnosis and follow-up
- Chronic pancreatitis
- Pancreatic cystic lesions
- Pancreatic tumors
- Pancreatic duct dilatation

5. SPLENIC CLINICAL APPLICATIONS

- Splenomegaly causes and grading
- Splenic trauma
- Splenic infarction
- Splenic cysts and tumors

6. URINARY SYSTEM CLINICAL APPLICATIONS

- Renal calculi detection
- Hydronephrosis grading
- Renal infections
- Renal cysts and tumors

- Bladder pathology
- Post-void residual urine assessment

7. GASTROINTESTINAL CLINICAL APPLICATIONS

- Acute appendicitis screening
- Intestinal obstruction
- Bowel wall thickening
- Hernia evaluation
- Abdominal masses

8. PERITONEAL & ABDOMINAL FLUID APPLICATIONS

- Ascites detection and grading
- Fluid localization for tapping
- Peritonitis suspicion
- Intra-abdominal collections

9. ABDOMINAL VASCULAR CLINICAL APPLICATIONS

- Abdominal aortic aneurysm screening
- Portal vein thrombosis detection
- Portal hypertension Doppler evaluation
- Hepatic vein abnormalities
- Renal artery stenosis screening

10. TRAUMA & EMERGENCY APPLICATIONS

- FAST scan clinical use
- Blunt abdominal trauma evaluation
- Free fluid detection
- Emergency acute abdomen evaluation

11. ONCOLOGY APPLICATIONS

- Tumor detection and localization
- Metastasis screening
- Tumor follow-up
- Lymph node assessment

12. INTERVENTIONAL ULTRASOUND APPLICATIONS

- Ultrasound guided aspiration
- Ultrasound guided biopsy basics
- Drainage procedure guidance

13. SPECIAL CLINICAL SITUATIONS

- Pediatric abdominal ultrasound basics
- Geriatric abdominal ultrasound considerations
- Post-operative abdomen evaluation
- ICU bedside ultrasound basics

14. CLINICAL CASE BASED LEARNING

- Case correlation with lab reports
- Case based ultrasound interpretation
- Differential diagnosis approach

15. REPORTING & CLINICAL DECISION SUPPORT

- Clinical oriented reporting format
- Urgent finding communication
- Follow-up scan recommendations
- Correlation with CT / MRI findings

16. SAFETY & QUALITY ASSURANCE

- ALARA principle in clinical practice
- Infection control
- Equipment quality check
- Documentation standards

Practical

➢ CLINICAL CASE PREPARATION & PATIENT HANDLING

- Clinical history taking before scan
- Correlation of symptoms with scan indication
- Patient preparation according to clinical condition
- Emergency vs routine scan preparation
- Patient counseling and consent

➢ CLINICAL SCANNING PROTOCOL PRACTICE

- Organ-wise scanning based on clinical complaints
- Selection of appropriate probe and preset
- Real-time scanning decision making
- Image optimization during pathology detection

➢ HEPATOBILIARY CLINICAL PRACTICAL

❖ Liver Clinical Scanning

- Fatty liver grading practice
- Cirrhosis pattern identification
- Liver mass screening protocol
- Portal vein diameter measurement
- Ascites with liver disease evaluation

❖ Gallbladder & Biliary Clinical Practice

- Gallstone detection and shadow confirmation
- Acute cholecystitis sonographic signs
- CBD measurement in obstructive jaundice
- Intrahepatic biliary dilatation detection

➢ PANCREAS CLINICAL PRACTICAL

- Pancreas visualization in difficult patients
- Acute pancreatitis screening
- Pancreatic duct visualization
- Pancreatic mass screening

➢ SPLENIC CLINICAL PRACTICAL

- Splenomegaly grading
- Splenic trauma fluid assessment
- Splenic lesion screening

➢ URINARY SYSTEM CLINICAL PRACTICAL

- Renal stone detection with twinkling artefact (if Doppler available)
- Hydronephrosis grading
- Renal infection screening
- Renal cyst vs solid mass differentiation
- Post void residual urine measurement
- Bladder mass screening

➢ GASTROINTESTINAL CLINICAL PRACTICAL

- Appendix visualization technique
- Bowel wall thickness measurement
- Intestinal obstruction fluid level assessment
- Hernia sac scanning

➢ PERITONEAL & FLUID RELATED CLINICAL PRACTICAL

- Ascites detection and grading
- Fluid pocket localization for tapping guidance
- Collection vs ascites differentiation

➢ ABDOMINAL VASCULAR CLINICAL PRACTICAL

- Abdominal aorta diameter measurement
- Aneurysm screening
- Portal vein Doppler flow assessment
- Hepatic vein waveform basics
- Renal artery Doppler screening (basic level)

➢ TRAUMA & EMERGENCY CLINICAL PRACTICAL

- FAST scan step-by-step practice
- Morrison pouch fluid detection
- Splenorenal pouch fluid detection
- Pelvic free fluid detection
- Pericardial fluid screening (basic FAST extension)

➢ ONCOLOGY CLINICAL PRACTICAL

- Tumor localization technique
- Size and margin assessment
- Lymph node scanning basics
- Follow-up scan comparison

➢ INTERVENTIONAL ULTRASOUND OBSERVATIONAL PRACTICAL

- Ultrasound guided aspiration observation
- Ultrasound guided biopsy observation
- Drainage catheter placement observation

OBSTETRICS, GYNECOLOGY & VASCULAR ULTRASOUND

Theory

PART – A : OBSTETRICS ULTRASOUND

1. INTRODUCTION TO OBSTETRIC ULTRASOUND

- Role of ultrasound in pregnancy
- Safety in obstetric ultrasound
- Indications and limitations
- Patient preparation and counseling
- Ultrasound in antenatal care

2. EMBRYOLOGY & FETAL DEVELOPMENT

- Fertilization and implantation
- Early embryonic development
- Placental development
- Fetal growth stages

3. FIRST TRIMESTER ULTRASOUND

- Confirmation of intrauterine pregnancy
- Gestational sac assessment
- Yolk sac visualization
- Fetal pole and cardiac activity
- Crown rump length (CRL) measurement
- Ectopic pregnancy detection
- Early pregnancy complications
    - Missed abortion
    - Blighted ovum
    - Subchorionic bleed

4. SECOND TRIMESTER ULTRASOUND (ANOMALY SCAN)

- Fetal biometry
    - BPD
    - HC
    - AC
    - FL
- Detailed fetal anatomy scan
    - Brain and spine
    - Face and neck
    - Thorax and heart (basic)
    - Abdomen
    - Kidneys and bladder
    - Limbs
- Placenta localization
- Amniotic fluid assessment

5. THIRD TRIMESTER ULTRASOUND

- Fetal growth monitoring
- Estimated fetal weight calculation
- Placental grading
- AFI measurement
- Fetal position and presentation
- Cord around neck detection

6. OBSTETRIC DOPPLER STUDIES

- Umbilical artery Doppler
- Middle cerebral artery Doppler
- Uterine artery Doppler
- Ductus venosus basics
- Doppler in IUGR evaluation

7. MULTIPLE PREGNANCY ULTRASOUND

- Twin pregnancy identification
- Chorionicity and amnionicity
- Twin complications screening

8. HIGH RISK PREGNANCY ULTRASOUND

- IUGR
- PIH related changes
- Placenta previa
- Placental abruption (basic screening)
- Oligohydramnios / Polyhydramnios

PART – B : GYNECOLOGY ULTRASOUND

9. FEMALE PELVIC ANATOMY & SCAN TECHNIQUES

- Transabdominal ultrasound
- Transvaginal ultrasound basics
- Uterus anatomy and measurement
- Endometrium assessment
- Ovarian morphology

10. UTERINE PATHOLOGY

- Fibroid uterus
- Adenomyosis basics

- Endometrial hyperplasia
- Endometrial polyp
- Endometrial carcinoma (screening features)

11. OVARIAN PATHOLOGY

- Functional cysts
- PCOS morphology
- Benign ovarian tumors
- Malignant ovarian tumor suspicion features

12. INFERTILITY ULTRASOUND BASICS

- Follicular monitoring
- Endometrial thickness monitoring
- Ovulation tracking

13. EARLY PREGNANCY GYNECOLOGICAL CONDITIONS

- Ectopic pregnancy
- Molar pregnancy
- Retained products of conception

PART – C : VASCULAR ULTRASOUND

14. INTRODUCTION TO VASCULAR ULTRASOUND

- Vascular ultrasound principles
- Doppler physics application
- Color Doppler basics
- Spectral Doppler basics

15. ARTERIAL DOPPLER STUDIES

- Carotid artery Doppler basics
- Peripheral arterial Doppler basics
- Renal artery Doppler basics

16. VENOUS DOPPLER STUDIES

- Deep vein thrombosis screening
- Venous insufficiency basics
- Portal venous Doppler

17. ABDOMINAL VASCULAR DOPPLER

- Aorta Doppler basics
- IVC evaluation
- Hepatic vein Doppler
- Portal hypertension Doppler evaluation

PART – D : CLINICAL APPLICATIONS & REPORTING

18. CLINICAL CORRELATION

- Correlation with clinical history
- Correlation with lab findings
- Case based interpretation

19. REPORT WRITING

- Obstetric ultrasound reporting
- Gynecology ultrasound reporting
- Doppler reporting basics

20. SAFETY & ETHICS

- ALARA principle
- Patient privacy and ethics
- Documentation standards

Practical

PART – A : OBSTETRICS ULTRASOUND PRACTICAL

➢ PATIENT PREPARATION & CLINICAL HISTORY

- Antenatal history taking before scan
- LMP calculation and gestational age correlation
- Bladder preparation (early pregnancy scan)
- Patient positioning and counseling
- Infection control and probe care

➢ FIRST TRIMESTER PRACTICAL SCANNING

- Gestational sac identification
- Yolk sac visualization
- Fetal pole identification

- Cardiac activity confirmation
- CRL measurement
- Gestational age calculation
- Ectopic pregnancy screening
- Subchorionic bleed identification

➢ SECOND TRIMESTER (ANOMALY SCAN) PRACTICAL

- Fetal biometry measurement
  - BPD measurement
  - HC measurement
  - AC measurement
  - FL measurement
- Basic fetal anatomy screening
  - Brain and spine
  - Face and neck
  - Thorax screening
  - Abdomen screening
  - Kidneys and bladder
  - Limbs

➢ THIRD TRIMESTER PRACTICAL

- Fetal growth monitoring
- Estimated fetal weight calculation
- Placental localization and grading
- AFI measurement technique
- Fetal presentation assessment

➢ OBSTETRIC DOPPLER PRACTICAL

- Umbilical artery Doppler waveform recording
- MCA Doppler basics
- Uterine artery Doppler
- Doppler indices measurement (PI, RI basics)

➢ MULTIPLE PREGNANCY PRACTICAL

- Twin pregnancy identification
- Chorionicity assessment basics
- Fetal position assessment

PART – B : GYNECOLOGY ULTRASOUND PRACTICAL

➢ PELVIC SCANNING TECHNIQUES

- Transabdominal pelvic scan
- Transvaginal scan observation / basic handling
- Uterus size measurement
- Endometrial thickness measurement
- Ovarian volume measurement

➢ UTERINE PATHOLOGY PRACTICAL

- Fibroid identification and measurement
- Endometrial thickness evaluation
- Endometrial polyp screening
- Adenomyosis suspicion features

➢ OVARIAN PATHOLOGY PRACTICAL

- Functional cyst identification
- PCOS morphology assessment
- Ovarian mass screening

➢ INFERTILITY PRACTICAL BASICS

- Follicular monitoring
- Dominant follicle measurement
- Ovulation tracking basics
- Endometrial pattern assessment

➢ EARLY PREGNANCY GYNECOLOGY PRACTICAL

- Ectopic pregnancy screening
- Molar pregnancy suspicion features
- Retained products screening

PART – C : VASCULAR ULTRASOUND PRACTICAL

➢ DOPPLER MACHINE HANDLING

- Doppler angle correction
- Sample volume placement
- Color box optimization
- Spectral waveform adjustment

➢ ARTERIAL DOPPLER PRACTICAL

- Carotid artery Doppler basics
- Peripheral arterial Doppler basics
- Renal artery Doppler basics

➢ VENOUS DOPPLER PRACTICAL

- DVT screening basics
- Venous compressibility test
- Venous flow waveform basics

➢ ABDOMINAL VASCULAR DOPPLER PRACTICAL

- Portal vein Doppler
- Hepatic vein waveform recording
- Abdominal aorta scanning
- IVC scanning

SEMESTER – III

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DUS301	ULTRASOUND TECHNIQUES & PROCEDURES	45 Min	1 Hrs.	50	50
DUS302	NEONATAL & PEDIATRIC ULTRASOUND	45 Min	1 Hrs.	50	50
DUS303	ULTRASOUND IN EMERGENCY AND CRITICAL CARE	45 Min	1 Hrs.	50	50
DUS304	OPERATION & HANDLING OF ULTRASOUND EQUIPMENT	45 Min	1 Hrs.	50	50

ULTRASOUND TECHNIQUES & PROCEDURES

Theory

1. INTRODUCTION TO ULTRASOUND TECHNIQUES

- Role of ultrasound in medical diagnosis
- Scope of diagnostic sonography
- Advantages and limitations of ultrasound
- Basic terminology used in ultrasound
- Patient safety and infection control
- Ethics and medico-legal considerations

2. ULTRASOUND PHYSICS

- Nature of ultrasound waves
- Frequency, wavelength and velocity
- Acoustic impedance
- Reflection, refraction and attenuation
- Resolution (axial, lateral, temporal)
- Artefacts in ultrasound imaging
    - Acoustic shadowing
    - Enhancement
    - Mirror image
    - Reverberation

3. ULTRASOUND EQUIPMENT & INSTRUMENTATION

- Ultrasound machine components
- Transducer types and selection
    - Linear probe
    - Curvilinear probe
    - Phased array probe
    - Endocavitary probe
- Machine controls (Knobology)
    - Gain
    - Depth
    - Focus
    - TGC
    - Dynamic range
- Image storage and data management

4. PATIENT PREPARATION & SCANNING PRINCIPLES

- Patient positioning techniques
- Preparation for abdominal scan
- Preparation for pelvic scan
- Preparation for obstetric scan
- Preparation for vascular Doppler scan
- Probe handling and ergonomics

5. SCANNING PLANES & IMAGE ORIENTATION

- Longitudinal plane scanning
- Transverse plane scanning
- Oblique plane scanning
- Image orientation and labeling
- Standard scanning protocols

6. B-MODE (2D) IMAGING TECHNIQUES

- Image optimization methods
- Tissue echogenicity recognition
- Measurement techniques
- Documentation standards

7. M-MODE TECHNIQUES

- Principle of M-mode
- Clinical applications (mainly cardiac basics)
- Motion analysis basics

8. DOPPLER ULTRASOUND TECHNIQUES

- Doppler principle
- Color Doppler technique
- Spectral Doppler technique
- Power Doppler basics
- Doppler angle correction
- Doppler artefacts

9. ADVANCED ULTRASOUND TECHNIQUES

- 3D / 4D ultrasound basics
- Elastography basics
- Contrast enhanced ultrasound (introduction)

10. ORGAN BASED SCANNING TECHNIQUES

❖ **Abdominal Scanning Techniques**

- Liver scanning protocol
- Gallbladder scanning protocol
- Pancreas scanning protocol
- Kidney scanning protocol

❖ **Pelvic Scanning Techniques**

- Transabdominal pelvic scan technique
- Transvaginal scan basics

❖ **Obstetric Scanning Techniques**

- Trimester-wise scanning approach
- Fetal biometry technique

❖ **Vascular Scanning Techniques**

- Arterial Doppler scanning technique
- Venous Doppler scanning technique

11. ULTRASOUND GUIDED PROCEDURES

- Principles of ultrasound guided interventions
- Needle visualization techniques
- Aspiration guidance basics
- Biopsy guidance basics
- Drainage catheter placement basics

12. QUALITY ASSURANCE & MACHINE MAINTENANCE

- Machine quality check
- Probe care and cleaning
- Artefact troubleshooting
- Calibration basics

13. SAFETY IN ULTRASOUND PRACTICE

- ALARA principle
- Thermal index and mechanical index basics
- Infection control
- Electrical safety

Practical

➢ **ULTRASOUND MACHINE HANDLING PRACTICAL**

- Machine start-up and shut-down procedure
- Preset selection according to examination
- Transducer selection and handling
- Image storage and retrieval
- Patient data entry and labeling

➢ KNOBOLGY & IMAGE OPTIMIZATION PRACTICAL

- Gain adjustment
- Depth and focus control
- Time gain compensation (TGC)
- Frequency and dynamic range adjustment
- Image optimization in different body habitus

➢ TRANSDUCER HANDLING & ERGONOMICS

- Probe grip techniques
- Orientation marker understanding
- Prevention of work-related musculoskeletal strain
- Probe pressure control

➢ SCANNING PLANES PRACTICAL

- Longitudinal scanning technique
- Transverse scanning technique
- Oblique scanning technique
- Multi-planar scanning approach

➢ B-MODE (2D) IMAGING PRACTICAL

- Tissue echogenicity identification
- Normal vs abnormal echo patterns
- Lesion size measurement
- Shape, margin and internal content assessment

➢ M-MODE PRACTICAL

- M-mode cursor placement
- Motion recording
- Basic clinical applications (heart rate confirmation in obstetrics)

➢ DOPPLER PRACTICAL TECHNIQUES

- Color Doppler application
- Spectral Doppler waveform acquisition
- Power Doppler basics
- Doppler angle correction
- Doppler artefact identification

➢ ORGAN-WISE SCANNING TECHNIQUE PRACTICAL

❖ Abdominal Techniques

- Liver scanning technique
- Gallbladder scanning technique
- Pancreas scanning technique
- Kidney scanning technique

❖ Pelvic Techniques

- Transabdominal pelvic scan technique
- Transvaginal scan observation and handling basics

❖ Obstetric Techniques

- First trimester scan technique
- Fetal biometry measurement technique
- Placenta localization technique

❖ Vascular Techniques

- Arterial Doppler scanning technique
- Venous Doppler scanning technique

➢ ULTRASOUND ARTEFACT IDENTIFICATION PRACTICAL

- Acoustic shadowing
- Posterior acoustic enhancement
- Mirror image artefact
- Reverberation artefact

➢ ULTRASOUND GUIDED PROCEDURES

- Needle visualization technique
- Ultrasound guided aspiration observation
- Ultrasound guided biopsy observation
- Drainage guidance observation

NEONATAL & PEDIATRIC ULTRASOUND

Theory

1. INTRODUCTION TO NEONATAL & PEDIATRIC ULTRASOUND

- Scope and importance of pediatric sonography
- Differences between adult and pediatric ultrasound
- Indications and limitations
- Patient preparation and handling
- Safety considerations in neonates and children
- Role of sonographer in pediatric imaging

2. PEDIATRIC & NEONATAL ANATOMY

- Developmental anatomy
- Age-related anatomical variations
- Normal sonographic appearance at different ages
- Congenital anomalies overview

3. NEONATAL CRANIAL ULTRASOUND

- Indications for cranial ultrasound
- Fontanelle anatomy
- Scanning windows and planes
- Normal neonatal brain anatomy
- Intraventricular hemorrhage grading
- Hydrocephalus
- Periventricular leukomalacia

4. NEONATAL ABDOMINAL ULTRASOUND

- Liver, spleen and pancreas evaluation
- Neonatal renal anatomy
- Hydronephrosis
- Congenital renal anomalies
- Neonatal abdominal masses

5. PEDIATRIC ABDOMINAL ULTRASOUND

- Pediatric liver disorders
- Pediatric gallbladder pathology
- Pediatric renal disease
- Intussusception
- Appendicitis in children

6. NEONATAL & PEDIATRIC URINARY SYSTEM

- Vesicoureteral reflux screening (basic ultrasound features)

- Posterior urethral valves screening
- Multicystic dysplastic kidney
- Renal cystic diseases

7. PEDIATRIC GASTROINTESTINAL ULTRASOUND

- Hypertrophic pyloric stenosis
- Necrotizing enterocolitis (basic features)
- Bowel obstruction
- Pediatric abdominal wall hernias

8. NEONATAL CHEST & THORACIC ULTRASOUND

- Pleural effusion
- Diaphragmatic hernia screening
- Lung ultrasound basics

9. PEDIATRIC VASCULAR ULTRASOUND (BASICS)

- Umbilical vessel evaluation
- Pediatric Doppler principles
- Renal artery Doppler basics

10. NEONATAL HIP ULTRASOUND

- Indications for hip ultrasound
- Graf method basics
- Developmental dysplasia of hip screening

11. PEDIATRIC SOFT TISSUE & MUSCULOSKELETAL ULTRASOUND

- Pediatric neck masses
- Thyroid ultrasound basics
- Lymph node evaluation
- Soft tissue swelling evaluation

12. PEDIATRIC EMERGENCY ULTRASOUND

- FAST scan in children
- Acute abdomen evaluation
- Trauma related ultrasound

13. PEDIATRIC ONCOLOGY ULTRASOUND

- Wilms tumor

- Neuroblastoma
- Lymphoma screening

14. INTERVENTIONAL PEDIATRIC ULTRASOUND (OBSERVATIONAL)

- Ultrasound guided aspiration
- Drainage guidance

15. REPORTING IN NEONATAL & PEDIATRIC ULTRASOUND

- Age-appropriate reporting terminology
- Growth chart correlation
- Follow-up scan recommendations

16. SAFETY, ETHICS & QUALITY ASSURANCE

- ALARA principle in pediatric practice
- Infection control
- Equipment safety
- Documentation standards

Practical

➢ PEDIATRIC & NEONATAL PATIENT HANDLING PRACTICAL

- Communication with parents / guardians
- Neonatal handling techniques
- Infection control precautions
- Temperature maintenance during scan
- Positioning techniques for neonates and children

➢ MACHINE & PROBE SELECTION PRACTICAL

- High frequency probe selection for pediatric imaging
- Small footprint probe handling
- Image optimization for small body structures

➢ NEONATAL CRANIAL ULTRASOUND PRACTICAL

- Anterior fontanelle scanning technique
- Coronal plane scanning
- Sagittal plane scanning
- Ventricular size measurement
- IVH grading identification (basic)
- Hydrocephalus assessment

➢ NEONATAL ABDOMINAL ULTRASOUND PRACTICAL

- Liver and spleen scanning technique
- Pancreas visualization basics
- Neonatal kidney scanning technique
- Congenital renal anomaly screening
- Neonatal abdominal mass screening

➢ PEDIATRIC ABDOMINAL ULTRASOUND PRACTICAL

- Pediatric liver disease screening
- Gallbladder pathology screening
- Renal disease screening
- Intussusception scanning technique
- Pediatric appendicitis screening

➢ PEDIATRIC URINARY SYSTEM PRACTICAL

- Kidney size measurement (age adjusted)
- Hydronephrosis grading
- Bladder wall thickness measurement
- Post void residual urine measurement

➢ PEDIATRIC GASTROINTESTINAL PRACTICAL

- Pyloric canal measurement (for pyloric stenosis screening)
- Bowel wall thickness assessment
- Bowel obstruction screening

➢ NEONATAL CHEST ULTRASOUND PRACTICAL (BASIC)

- Pleural fluid detection
- Lung sliding identification basics

➢ PEDIATRIC VASCULAR DOPPLER PRACTICAL

- Umbilical vessel Doppler basics
- Pediatric renal Doppler basics

➢ NEONATAL HIP ULTRASOUND PRACTICAL Hip joint probe placement

- Graf angle measurement basics

➢ PEDIATRIC SOFT TISSUE PRACTICAL

- Neck mass scanning
- Lymph node scanning technique
- Soft tissue swelling evaluation

➢ PEDIATRIC EMERGENCY ULTRASOUND PRACTICAL

- FAST scan in children (basic protocol)
- Free fluid detection
- Trauma abdomen screening

➢ INTERVENTIONAL PEDIATRIC ULTRASOUND (OBSERVATIONAL)

- Ultrasound guided aspiration observation
- Fluid collection drainage observation

ULTRASOUND IN EMERGENCY AND CRITICAL CARE

Theory

1. INTRODUCTION TO EMERGENCY & CRITICAL CARE ULTRASOUND

- Role of ultrasound in emergency medicine
- Point of Care Ultrasound (POCUS) concept
- Advantages in emergency diagnosis
- Limitations of emergency ultrasound
- Indications and contraindications
- Bedside ultrasound applications

2. BASICS OF EMERGENCY ULTRASOUND TECHNIQUES

- Rapid scanning protocols
- Probe selection in emergency settings
- Machine preset selection for emergency scans
- Image optimization in unstable patients
- Infection control in emergency setup

3. TRAUMA ULTRASOUND APPLICATIONS

- FAST scan protocol
- Extended FAST (eFAST) basics

- Free fluid detection in trauma
- Pneumothorax screening (eFAST lung views)
- Hemothorax detection

4. ACUTE ABDOMEN EMERGENCY ULTRASOUND

- Acute appendicitis screening
- Acute cholecystitis screening
- Bowel obstruction screening
- Abdominal aortic aneurysm screening
- Renal colic evaluation (stone + hydronephrosis)

5. EMERGENCY OBSTETRIC & GYNECOLOGICAL ULTRASOUND

- Early pregnancy confirmation
- Ectopic pregnancy screening
- First trimester bleeding evaluation
- Retained products screening

6. EMERGENCY CARDIAC ULTRASOUND

- Pericardial effusion detection
- Basic cardiac activity assessment
- Cardiac tamponade suspicion features
- Basic cardiac contractility assessment

7. EMERGENCY VASCULAR ULTRASOUND

- DVT screening in emergency
- Peripheral arterial flow assessment basics
- Central line placement guidance (introduction)

8. EMERGENCY LUNG ULTRASOUND

- Pleural effusion detection
- Pneumothorax detection
- Pulmonary edema (B-line basics)

9. ULTRASOUND IN SHOCK ASSESSMENT

- Hypovolemic shock ultrasound features
- Cardiogenic shock basics
- Obstructive shock ultrasound features
- Septic shock supportive ultrasound findings

10. PEDIATRIC EMERGENCY ULTRASOUND

- Pediatric FAST scan basics
- Intussusception screening
- Pediatric appendicitis screening

11. ULTRASOUND GUIDED EMERGENCY PROCEDURES

- Central venous catheter guidance basics
- Fluid aspiration basics
- Abscess drainage basics
- Thoracentesis and paracentesis basics

12. ICU ULTRASOUND APPLICATIONS

- Bedside ultrasound monitoring
- Fluid status evaluation (IVC basics)
- Ventilator patient lung ultrasound basics
- Serial ultrasound monitoring

13. CLINICAL CORRELATION & CASE BASED LEARNING

- Correlation with vital signs
- Correlation with lab values
- Case based emergency ultrasound interpretation

14. REPORTING IN EMERGENCY ULTRASOUND

- Rapid reporting format
- Critical finding communication protocol
- Documentation standards

15. SAFETY & ETHICS IN EMERGENCY ULTRASOUND

- Patient safety in emergency scanning
- ALARA principle
- Infection control
- Medico-legal documentation

16. QUALITY ASSURANCE & EQUIPMENT CARE

- Emergency machine maintenance
- Probe care in emergency settings
- Artefact troubleshooting

Practical

➢ EMERGENCY ULTRASOUND SETUP & MACHINE HANDLING

- Rapid machine start-up and preset selection
- Probe selection for emergency scans
- Image optimization in unstable patients
- Infection control and probe protection
- Portable ultrasound handling

➢ RAPID SCANNING TECHNIQUES

- Focused scanning approach
- Limited view protocol application
- Time-critical decision scanning
- Avoidance of unnecessary delays

➢ TRAUMA ULTRASOUND PRACTICAL

❖ FAST Scan

- Subxiphoid (pericardial) view
- Right upper quadrant (Morrison's pouch)
- Left upper quadrant (splenorenal pouch)
- Pelvic view (pouch of Douglas)

❖ eFAST Scan

- Lung views for pneumothorax
- Pleural views for hemothorax

➢ ACUTE ABDOMEN EMERGENCY PRACTICAL

- Free intraperitoneal fluid detection
- Acute cholecystitis screening
- Acute appendicitis screening
- Bowel obstruction screening
- Abdominal aorta aneurysm screening
- Renal colic (stone + hydronephrosis)

➢ EMERGENCY OBSTETRIC & GYNECOLOGY PRACTICAL

- Confirmation of intrauterine pregnancy
- Detection of free fluid in early pregnancy
- Ectopic pregnancy screening

- Retained products of conception screening

➢ EMERGENCY CARDIAC ULTRASOUND PRACTICAL

- Cardiac activity assessment
- Pericardial effusion detection
- Tamponade suspicion features
- Basic contractility assessment

➢ EMERGENCY LUNG ULTRASOUND PRACTICAL

- Pleural effusion detection
- Pneumothorax screening
- Lung sliding identification
- B-line identification

➢ EMERGENCY VASCULAR ULTRASOUND PRACTICAL

- DVT compression ultrasound
- Peripheral arterial flow screening
- IVC diameter assessment for fluid status

➢ SHOCK ASSESSMENT ULTRASOUND PRACTICAL

- Hypovolemic shock ultrasound signs
- Cardiogenic shock screening
- Obstructive shock screening
- Septic shock supportive findings

➢ PEDIATRIC EMERGENCY ULTRASOUND PRACTICAL

- Pediatric FAST scan basics
- Intussusception screening
- Pediatric appendicitis screening

➢ ICU BEDSIDE ULTRASOUND PRACTICAL

- Bedside monitoring scans
- Serial ultrasound assessment
- Lung ultrasound in ventilated patients
- IVC assessment for volume status

➢ ULTRASOUND GUIDED EMERGENCY PROCEDURES

- Central venous catheter guidance

- Thoracentesis observation
- Paracentesis observation
- Abscess drainage observation

OPERATION & HANDLING OF ULTRASOUND EQUIPMENT

Theory

1. Introduction to Ultrasound Equipment

- Evolution of ultrasound machines
- Types of ultrasound systems (Portable, Cart-based, Handheld)
- Basic components of ultrasound machine
- Role of ultrasound equipment in diagnosis
- Clinical applications overview

Ultrasound courses commonly teach system components, transducers, beam forming and display modes as the base of machine operation.

2. Ultrasound Machine Components

- Main console and system architecture
- Control panel and user interface
- Monitor and display system
- CPU and processing unit
- Storage devices and PACS connectivity
- Power supply and backup systems

Instrumentation training includes pulse-echo systems, display modes, recording and storage systems used in real-time imaging.

3. Transducers and Probe Handling

- Types of probes (Linear, Curvilinear, Phased array, Endocavitary)
- Probe selection according to examination
- Probe frequency and penetration relationship
- Probe care and maintenance
- Probe disinfection and sterilization

Training modules cover transducer types, selection, and their frequency relationships in image formation.

4. Knobology (Machine Controls & Image Optimization)

- Power ON/OFF procedure
- Preset selection
- Gain and Time Gain Compensation (TGC)
- Depth, Focus, Dynamic Range
- Freeze and Image Storage
- Measurements and Caliper use
- Cine loop operation

System operation training focuses on equipment controls and techniques needed to create and optimize ultrasound images.

5. Imaging Modes and Operation

- B-Mode (Gray Scale Imaging)
- M-Mode
- Doppler Modes
  - Color Doppler
  - Power Doppler
  - Spectral Doppler
- 3D/4D imaging basics

Instrumentation courses typically include imaging modes, Doppler imaging, and artifact recognition.

6. Image Formation and Processing

- Pulse-echo principle
- Beam formation
- Resolution concepts
- Pre-processing and Post-processing
- Tissue harmonic imaging
- Image artifacts and correction

Image formation, beam formation, and processing techniques are core parts of instrumentation syllabus.

7. Equipment Safety and Bioeffects

- Biological effects of ultrasound
- ALARA principle
- Thermal and Mechanical Index
- Patient safety during scanning
- Operator safety

Ultrasound training emphasizes biological effects, ALARA, and patient care safety protocols.

8. Infection Control & Machine Hygiene

- Probe cleaning protocols
- Use of probe covers
- Disinfection levels (Low, Intermediate, High level)
- Infection prevention during scanning

Training modules include biosafety and infection control practices in ultrasound procedures.

9. Equipment Quality Assurance & Maintenance

- Routine equipment checks
- Preventive maintenance
- Calibration basics
- Troubleshooting common problems
- Service documentation

Quality assurance and quality control of ultrasound equipment are standard parts of sonography instrumentation training.

10. Recent Advances in Ultrasound Equipment

- AI integration in ultrasound
- Portable ultrasound trends
- Automated measurements
- Cloud-based reporting

Practical

- **Introduction to Ultrasound Machine (Hands-On)**

- Identification of machine parts
- Understanding control panel layout
- Power ON and shutdown procedure
- Connecting probes and accessories

- **Machine Setup & Preparation**

- System booting and login procedure
- Patient data entry and worklist selection
- Preset selection according to examination
- Monitor and system setting adjustment

- **Probe Handling & Care**

- Identification of different probes
  - Linear probe
  - Curvilinear probe
  - Phased array probe
  - Endocavitary probe
- Probe connection and disconnection
- Proper probe holding technique
- Probe cleaning and disinfection practice
- Use of probe covers and gel application

➢ **Basic Knobology Practice**

- Gain adjustment
- Time Gain Compensation (TGC) adjustment
- Depth selection
- Focus position adjustment
- Dynamic range adjustment
- Freeze and unfreeze operation
- Image store and delete functions

➢ **Image Optimization Techniques**

- Achieving proper image brightness
- Reducing noise and artifacts
- Adjusting frequency selection
- Optimization using presets
- Tissue harmonic imaging activation

➢ **Imaging Mode Operation**

- B-Mode scanning practice
- M-Mode operation practice
- Color Doppler activation and adjustment
- Power Doppler operation
- Spectral Doppler basic settings

➢ **Measurement & Documentation**

- Use of calipers for measurement
- Distance measurement
- Area and volume measurement (basic)
- Image labeling practice
- Image storage and retrieval
- Printing and digital export

➢ **Patient Positioning & Preparation**

- Patient positioning for different scans
- Communication with patient during scan
- Use of gel and infection prevention

➢ **Equipment Safety Practice**

- Application of ALARA principle
- Monitoring Thermal Index (TI) and Mechanical Index (MI)
- Safe scanning time management

➢ **Infection Control Practice**

- Probe cleaning after each patient
- Machine surface disinfection
- Handling biohazard materials
- PPE use during procedures

➢ **Equipment Maintenance & Troubleshooting**

- Daily machine inspection
- Checking cables and connectors
- Identifying common errors
- Basic troubleshooting steps
- Reporting technical faults

SEMESTER – IV

PAPER CODE	SUBJECT NAME	THEORY HOURS	PRACTICAL HOURS	THEORY MARKS	PRACTICAL MARKS
DUS401	GYNECOLOGICAL SONOGRAPHY	45 Min	1 Hrs.	50	50
DUS402	PELVIC SONOGRAPHY (MALE & FEMALE)	45 Min	1 Hrs.	50	50
DUS403	QUALITY ASSURANCE & MAINTENANCE IN ULTRASOUND IMAGING	45 Min	1 Hrs.	50	50
DUS404	ULTRASOUND SAFETY, ETHICS & LEGAL ASPECTS	45 Min	1 Hrs.	50	50

GYNECOLOGICAL SONOGRAPHY

Theory

1. Introduction to Gynecological Sonography

- Definition and scope of gynecological ultrasound
- Role of ultrasound in gynecology
- Indications and contraindications
- Advantages and limitations of ultrasound
- Types of gynecological ultrasound
    - Transabdominal
    - Transvaginal

2. Female Pelvic Anatomy (Ultrasound Correlation)

- Anatomy of female pelvis
- Uterus
    - Shape, position, layers
- Cervix
- Endometrium
- Ovaries
- Fallopian tubes
- Pelvic ligaments
- Pelvic peritoneal spaces
- Normal ultrasound appearance of pelvic organs

3. Patient Preparation & Scanning Techniques

- Patient history and consent
- Patient preparation for transabdominal scan
- Patient preparation for transvaginal scan
- Bladder filling protocols
- Patient positioning
- Probe selection and frequency
- Scanning planes and orientation

4. Normal Sonographic Anatomy

- Normal uterus measurements
- Endometrial thickness in different phases of menstrual cycle
- Normal ovarian size and follicles
- Normal pelvic landmarks
- Normal vascular patterns

5. Menstrual Cycle & Hormonal Influence

- Phases of menstrual cycle
- Hormonal changes and their effect on uterus and endometrium
- Sonographic appearance in:

  - Proliferative phase
  - Secretory phase
  - Menstrual phase

6. Uterine Pathologies

- Congenital uterine anomalies
- Fibroid uterus (Leiomyoma)
  - Types and locations
  - Sonographic features
- Adenomyosis
- Endometrial hyperplasia
- Endometrial polyp
- Endometritis
- Uterine malignancies

7. Ovarian Pathologies

- Functional ovarian cysts
- Polycystic ovarian syndrome (PCOS)
- Benign ovarian tumors
- Malignant ovarian tumors
- Ovarian torsion
- Endometrioma
- Sonographic criteria for ovarian masses

8. Adnexal & Tubal Pathologies

- Hydrosalpinx
- Pyosalpinx
- Tubo-ovarian mass
- Pelvic inflammatory disease (PID)
- Adnexal masses

9. Pelvic Free Fluid & Masses

- Physiological free fluid
- Pathological free fluid
- Pelvic abscess
- Pelvic masses – solid vs cystic
- Differential diagnosis

10. Early Pregnancy Evaluation (Gynecological Aspect)

- Pregnancy of unknown location
- Ectopic pregnancy

- Sonographic signs of ectopic pregnancy
- Corpus luteum cyst
- Differentiation between ectopic and adnexal mass

11. Doppler in Gynecological Sonography

- Principles of Doppler ultrasound
- Uterine artery Doppler
- Ovarian artery Doppler
- Doppler findings in:
  - Fibroids
  - Ovarian tumors
  - PCOS
- Color and spectral Doppler patterns

12. Transvaginal Sonography (TVS)

- Indications for TVS
- Advantages over transabdominal scan
- Probe preparation and care
- Technique of TVS
- Normal and abnormal TVS findings

13. Ultrasound in Infertility Evaluation

- Baseline pelvic scan
- Follicular monitoring
- Endometrial assessment
- Ovulation detection
- Luteal phase assessment

14. Ultrasound-Guided Gynecological Procedures

- Follicular aspiration
- Cyst aspiration
- Abscess drainage

15. Safety, Ethics & Legal Aspects

- Ultrasound safety principles
- Infection control
- Ethical considerations in gynecological scanning
- Legal responsibilities of sonographer
- PC-PNDT Act

Practical

➢ **Patient Preparation & Communication**

- Taking brief clinical history
- Explaining procedure to patient
- Obtaining consent (especially for TVS)
- Bladder preparation for transabdominal scan
- Patient positioning techniques

➢ **Machine Preparation & Probe Selection**

- Selection of correct preset (Gyne / Pelvis)
- Selection of probe
    - Curvilinear probe – Transabdominal scan
    - Endocavitary probe – Transvaginal scan
- Probe preparation and cover application
- Gel application technique

➢ **Pelvic Scanning Techniques – Transabdominal**

- Identification of uterus in longitudinal and transverse planes
- Measurement of uterus (Length, AP, Width)
- Endometrial thickness measurement
- Identification of cervix
- Identification of ovaries
- Ovarian measurement and follicle assessment
- Detection of pelvic free fluid

➢ **Transvaginal Sonography (TVS) – Hands-On**

- Probe cleaning and preparation
- Use of probe cover
- Patient positioning (Lithotomy position basics)
- Probe insertion technique (Simulation / Supervised)
- Visualization of uterus and endometrium
- Visualization of ovaries and follicles
- Assessment of adnexa

➢ **Normal Pelvic Anatomy Identification**

- Normal uterus appearance
- Endometrium in different menstrual phases
- Normal ovarian morphology
- Dominant follicle identification
- Corpus luteum identification

➢ **Measurement Skills Practice**

- Uterus size measurement
- Endometrial thickness measurement
- Ovarian volume calculation
- Follicle size measurement
- Simple cyst measurement

➢ **Pathology Identification**

- Fibroid uterus identification
- Ovarian cyst identification
- PCOS appearance recognition
- Endometrial thickening recognition
- Pelvic inflammatory changes (basic)
- Adnexal mass detection (basic)

➢ **Doppler Practice in Gynecology**

- Activation of color Doppler
- Identification of uterine artery flow
- Ovarian vascularity assessment
- Basic spectral Doppler tracing

➢ **Infertility Scan Basics**

- Baseline pelvic scan
- Follicular monitoring practice
- Endometrial pattern assessment
- Ovulation monitoring basics

➢ **Early Pregnancy Gynecological Assessment**

- Identification of gestational sac (early stage)
- Identification of yolk sac (if visible)
- Differentiation of corpus luteum vs cyst (basic)
- Suspicion of ectopic pregnancy signs (awareness level)

➢ **Infection Control & Safety Practice**

- Probe disinfection after use
- High-level disinfection protocol awareness
- PPE use during scanning
- Biomedical waste disposal

PELVIC SONOGRAPHY (MALE & FEMALE)

Theory

1. Introduction to Pelvic Sonography

- Definition and scope of pelvic ultrasound
- Role in male and female pelvic disease diagnosis
- Indications of pelvic ultrasound
- Advantages and limitations
- Types of pelvic ultrasound
    - Transabdominal
    - Transvaginal (Female)
    - Transrectal (Male)

2. Pelvic Anatomy (Ultrasound Correlation)

Female Pelvic Anatomy

- Uterus and cervix
- Endometrium
- Ovaries
- Fallopian tubes Adnexa
- Pelvic spaces

Male Pelvic Anatomy

- Urinary bladder
- Prostate gland
- Seminal vesicles
- Vas deferens
- Surrounding pelvic structures

3. Patient Preparation & Scanning Techniques

- Patient history taking
- Bladder preparation protocols
- Patient positioning
- Probe selection and frequency selection
- Scanning planes and orientation
- Transabdominal scanning technique
- Basic principles of TVS and TRUS

4. Normal Sonographic Appearance

Female

- Normal uterus and endometrium
- Normal ovarian morphology
- Normal follicular development

Male

- Normal bladder wall thickness
- Normal prostate size and volume
- Normal seminal vesicle appearance

5. Female Pelvic Pathologies

Uterine Disorders

- Fibroid uterus
- Adenomyosis
- Endometrial hyperplasia
- Endometrial polyp
- Uterine malignancy

Ovarian Disorders

- Functional cysts
- PCOS
- Benign ovarian tumors
- Malignant ovarian tumors
- Ovarian torsion

Adnexal & Pelvic Disorders

- Pelvic inflammatory disease
- Hydrosalpinx
- Tubo-ovarian mass
- Pelvic free fluid

6. Male Pelvic Pathologies

- Benign Prostatic Hyperplasia (BPH)
- Prostatitis
- Prostate carcinoma
- Prostatic cysts
- Bladder outlet obstruction
- Bladder mass
- Bladder calculi
- Post-void residual urine assessment

7. Early Pregnancy Pelvic Evaluation (Female)

- Pregnancy of unknown location
- Ectopic pregnancy

- Corpus luteum identification
- Early gestational sac identification

8. Doppler in Pelvic Sonography

- Basic Doppler principles
- Uterine artery Doppler
- Ovarian blood flow
- Prostatic vascularity assessment
- Doppler in pelvic masses

9. Pelvic Sonography in Infertility

- Female infertility ultrasound role
- Follicular monitoring basics
- Endometrial evaluation
- Male infertility – prostate and seminal vesicle evaluation (basic overview)

10. Ultrasound-Guided Pelvic Procedures

- Cyst aspiration
- Abscess drainage
- Prostate biopsy (basic theoretical concept)

11. Safety, Infection Control & Ethics

- Infection control during pelvic scans
- Probe disinfection protocols
- Patient privacy and dignity
- Ethical issues in pelvic scanning
- Legal aspects (PC-PNDT awareness – female scans relevance)

Practical

➢ Patient Preparation & Communication

- Taking relevant clinical history
- Explaining pelvic ultrasound procedure
- Obtaining consent (especially for TVS / TRUS awareness)
- Bladder preparation instructions
- Patient positioning techniques

➢ Machine Preparation & Probe Selection

- Selection of pelvic preset

- Probe selection
  - Curvilinear probe – Transabdominal pelvic scan
  - Endocavitary probe – Transvaginal scan
- Frequency selection
- Gel application technique

➢ Transabdominal Pelvic Scan – Female (Hands-On)

- Identification of uterus in longitudinal and transverse planes
- Uterus measurement (Length, AP, Width)
- Endometrial thickness measurement
- Cervix identification
- Ovarian identification and localization
- Ovarian measurement and follicle assessment
- Detection of pelvic free fluid

➢ Transabdominal Pelvic Scan – Male (Hands-On)

- Urinary bladder evaluation
- Bladder wall thickness assessment
- Detection of bladder mass or calculi
- Prostate visualization through transabdominal route
- Prostate size measurement
- Post-void residual urine (PVR) measurement

➢ Transvaginal Sonography (TVS)

- Probe cleaning and preparation
- Use of probe cover
- Patient positioning
- Assistance during TVS procedure
- Identification of uterus, endometrium, ovaries
- Adnexal evaluation

➢ Transrectal Ultrasound (TRUS) – Demonstration Level

- Probe preparation awareness
- Patient preparation awareness
- Observation of prostate imaging
- Basic understanding of prostate measurement

➢ Normal Anatomy Identification Practice

Female

- Normal uterus appearance

- Endometrial phase appearance
- Normal ovarian morphology
- Dominant follicle identification

Male

- Normal bladder appearance
- Normal prostate appearance
- Normal seminal vesicle appearance

➢ Measurement Skills Practice

- Uterus measurement
- Endometrial thickness measurement
- Ovarian volume calculation
- Follicle measurement
- Prostate volume calculation
- Post-void residual urine measurement

➢ Basic Pathology Identification Practice

Female

- Fibroid uterus (basic identification)
- Ovarian cyst identification
- PCOS appearance recognition
- Adnexal mass detection (basic)
- Pelvic free fluid detection

Male

- Prostate enlargement (BPH – basic recognition)
- Bladder stone detection (basic)
- Bladder mass suspicion (awareness level)

➢ Doppler Practice

- Activation of Color Doppler
- Uterine artery flow identification (female)
- Ovarian vascularity basic assessment
- Prostatic vascularity basic assessment

➢ Infection Control & Safety Practice

- Probe disinfection after each patient
- High-level disinfection protocol awareness

- PPE use
- Biomedical waste disposal basics

QUALITY ASSURANCE & MAINTENANCE IN ULTRASOUND IMAGING

Theory

1. Introduction to Quality Assurance (QA) in Ultrasound

- Definition of Quality Assurance (QA)
- Definition of Quality Control (QC)
- Importance of QA in medical imaging
- Goals of QA programs
- Role of sonographer in QA
- Regulatory requirements in ultrasound QA

2. Fundamentals of Ultrasound Equipment Performance

- Basic working principles of ultrasound equipment
- System components affecting image quality
- Factors influencing image quality
    - Resolution
    - Penetration
    - Noise
    - Artifacts
- Importance of equipment performance monitoring

3. Quality Control Tests in Ultrasound

- Visual inspection tests
- Uniformity testing
- Depth of penetration testing
- Distance measurement accuracy testing
- Axial and lateral resolution testing
- Gray scale and contrast resolution testing
- Doppler performance testing

4. Ultrasound Phantom Testing

- Types of ultrasound phantoms
- Purpose of phantom testing
- Use of tissue-equivalent phantoms
- Phantom-based QC procedures

- Documentation of phantom test results

5. Transducer Quality Assurance

- Transducer construction basics
- Common probe faults
- Cable damage detection
- Drop damage effects
- Dead element detection
- Transducer sensitivity testing
- Probe cleaning and care

6. Preventive Maintenance of Ultrasound Equipment

- Daily maintenance procedures
- Weekly maintenance checks
- Monthly maintenance checks
- Annual servicing and calibration
- Environmental considerations
    - Temperature
    - Humidity
    - Electrical supply stability

7. Troubleshooting Ultrasound Equipment

- Common machine errors
- Image artifacts due to equipment fault
- Transducer malfunction signs
- System software errors
- When to call service engineer
- Documentation of faults

8. Safety in Ultrasound Equipment

- Electrical safety
- Mechanical safety
- Biological effects of ultrasound
- ALARA principle
- Thermal Index (TI) and Mechanical Index (MI) monitoring
- Patient and operator safety

9. Infection Control & Equipment Hygiene

- Probe disinfection protocols
- High-level disinfection requirements
- Cross infection prevention

- Gel contamination prevention
- Cleaning of machine surfaces

10. Quality Improvement in Ultrasound Services

- Continuous quality improvement (CQI)
- Audit of ultrasound reports
- Image quality audit
- Patient feedback monitoring
- Staff training and competency evaluation

Practical

➢ Ultrasound Machine Inspection (Hands-On)

- Visual inspection of machine body
- Checking monitor and display clarity
- Checking keyboard and control panel function
- Checking cables and connectors
- Checking probe surface integrity

➢ Daily Quality Control Checks

- Machine start-up self-test observation
- Image uniformity check
- Basic image quality assessment
- Checking system presets function
- Checking printer and storage function

➢ Ultrasound Phantom Testing Practice

- Identification of phantom parts
- Performing depth of penetration test
- Distance measurement accuracy test
- Axial resolution testing
- Lateral resolution testing
- Recording phantom test observations

➢ Transducer Quality Check

- Checking probe face for cracks
- Checking cable for damage
- Identifying drop damage signs
- Recognition of dead element artifact pattern
- Sensitivity comparison practice

➢ Preventive Maintenance Practice

- Daily cleaning of ultrasound machine
- Cleaning of monitor and keyboard
- Safe storage of probes
- Proper cable handling technique
- Checking ventilation openings

➢ Infection Control & Disinfection Practice

- Low-level probe cleaning procedure
- High-level disinfection awareness
- Use of disinfectant solutions
- Cleaning after each patient
- Use of PPE during probe cleaning

➢ Electrical Safety Practice

- Checking power cable condition
- Proper earthing awareness
- Safe plug and socket usage
- Safe machine switching procedures

➢ Basic Troubleshooting Practice

- Identifying no-image problem
- Identifying probe connection error
- Identifying system freeze or software error
- Identifying poor image quality due to settings vs hardware
- Documentation of machine fault

➢ Doppler Quality Check

- Doppler activation testing
- Checking color fill uniformity
- Checking spectral waveform clarity

ULTRASOUND SAFETY, ETHICS & LEGAL ASPECTS

Theory

1. Introduction to Ultrasound Safety

- Definition of ultrasound safety
- Importance of safety in diagnostic ultrasound
- Difference between diagnostic and therapeutic ultrasound
- Responsibilities of sonographer in safe practice

2. Basic Physics Related to Ultrasound Safety

- Nature of ultrasound waves
- Interaction of ultrasound with tissues
- Energy transmission in ultrasound
- Factors affecting ultrasound exposure
    - Frequency
    - Intensity
    - Time of exposure

3. Biological Effects of Ultrasound

- Thermal effects of ultrasound
- Mechanical effects of ultrasound
- Cavitation (stable and unstable – basic concept)
- Tissue heating mechanisms
- Sensitive tissues and organs
- Safety concerns in pregnancy

4. ALARA Principle

- Meaning of ALARA (As Low As Reasonably Achievable)
- Importance of ALARA in ultrasound practice
- Practical application of ALARA during scanning
- Minimizing scan time and output power

5. Safety Indices in Ultrasound

- Thermal Index (TI)
- Mechanical Index (MI)
- Interpretation of TI and MI values
- Monitoring safety indices during scanning
- Safe limits and operator responsibility

6. Patient Safety in Ultrasound

- Patient preparation and comfort
- Avoiding unnecessary scans

- Proper patient positioning
- Infection control and hygiene
- Safety during transvaginal and transrectal scans

7. Operator (Sonographer) Safety

- Ergonomics in ultrasound
- Prevention of musculoskeletal injuries
- Safe posture and scanning techniques
- Electrical safety awareness
- Stress and workload management

8. Infection Control in Ultrasound Practice

- Types of infection transmission
- Probe cleaning and disinfection
- Levels of disinfection
  - Low-level
  - High-level
- Use of probe covers
- Gel handling and contamination prevention
- Biomedical waste disposal

9. Ethical Principles in Medical Imaging

- Definition of medical ethics
- Ethical principles
  - Autonomy
  - Beneficence
  - Non-maleficence
  - Justice
- Professional behavior and responsibility
- Ethical decision-making in ultrasound practice

10. Ethics in Ultrasound Practice

- Patient privacy and confidentiality
- Informed consent
- Respect for patient dignity
- Ethical issues in obstetric and gynecological ultrasound
- Ethical handling of sensitive findings

11. Legal Responsibilities of Sonographer

- Scope of practice of sonographer
- Professional accountability

- Documentation and record keeping
- Legal implications of incorrect reporting
- Negligence and malpractice

12. PC-PNDT Act (Pre-Conception & Pre-Natal Diagnostic Techniques Act)

- Introduction and objectives of PC-PNDT Act
- History and need for the Act
- Key provisions of the Act
- Prohibition of sex determination
- Responsibilities of ultrasound centers
- Responsibilities of sonographers and radiologists
- Registration requirements
- Record keeping and Form-F
- Punishments and penalties

13. Consent, Confidentiality & Documentation

- Importance of informed consent
- Types of consent
- Patient confidentiality laws
- Safe storage of patient records
- Legal importance of proper documentation

14. Accreditation & Regulatory Bodies

- Role of government authorities
- NABH awareness
- Institutional policies and SOPs
- Audit and inspection procedures

15. Professional Conduct & Ethics

- Code of conduct for sonographers
- Communication skills
- Dealing with patients and attendants
- Ethical teamwork with doctors and staff

16. Emerging Ethical & Legal Issues

- Use of AI in ultrasound
- Tele-ultrasound
- Data security and digital reporting
- Ethical challenges with new technologies

Practical

1. Patient Safety Practice

- Patient identity verification
- Checking investigation requisition
- Explaining procedure to patient
- Taking informed consent
- Ensuring patient comfort and privacy
- Safe patient positioning during scan

2. Application of ALARA Principle (Hands-On)

- Reducing output power during scanning
- Reducing scan time
- Optimizing machine settings for safety
- Avoiding unnecessary repeat scans
- Monitoring exposure during real-time scanning

3. Monitoring Safety Indices Practice

- Observing Thermal Index (TI) during scanning
- Observing Mechanical Index (MI) during scanning
- Maintaining safe TI and MI levels during pregnancy scans
- Recording safety index values

4. Infection Control Practical Training

- Hand hygiene practice
- Probe cleaning after each patient
- Low-level disinfection practice
- High-level disinfection awareness (TVS / TRUS probes)
- Use of probe covers
- Safe gel handling practice

5. PPE & Biomedical Waste Management

- Use of gloves, mask, apron
- Disposal of contaminated materials
- Segregation of biomedical waste

6. Operator Safety & Ergonomics Practice

- Correct sitting posture during scanning
- Proper patient bed height adjustment

- Proper probe holding technique
- Prevention of repetitive strain injury

7. Electrical & Equipment Safety Practice

- Checking machine power cables
- Checking earthing awareness
- Safe ON/OFF machine handling
- Avoiding liquid spill near equipment

8. Ethical Practice – Clinical Scenario Training

- Maintaining patient confidentiality
- Respecting patient dignity during pelvic scans
- Handling sensitive findings ethically
- Communicating with patient professionally
- Handling relatives and attendants professionally

9. Legal Documentation Practice (India – PC-PNDT Awareness)

- Awareness of Form-F documentation
- Checking patient identity documents
- Record entry practice (simulation)
- Maintaining ultrasound registers

LIST OF HOLIDAYS

TOTAL DAY IN 1 YEAR	365/366
SUNDAY	52 DAYS
SUMMER VACATION	10 DAYS
WINTER VACATION	10 DAYS
GAZETTED HOLIDAYS	23 DAYS
OTHER HOLIDAYS	20 DAYS
TOTAL HOLIDAYS	115 DAYS
TOTAL WORKING DAYS	365-115=250

TOTAL HOURS

THEORY CLASS PER DAY	3 HOURS
PRACTICAL CLASS PER DAY	4 HOURS
TOTAL HOURS PER DAY	7 HOURS
TOTAL HOURS IN 1 YEAR	250*7=1750
TOTAL HOURS IN 6 MONTHS	875 HOURS

Chairman

Paramedical Education & Training Council