

**SYLLABUS**  
**First year**  
**Paper 1 - Basic Sciences I**  
**(30 hours)**

**Anatomy(12 hours)**

- 1. The cell**
  - a. Organelles
  - b. Internal organization
  - c. Cell cycle control
  - d. Mitosis & meiosis
- 2. Gross Anatomy**
  - a. Male reproductive system
  - b. Female reproductive system
- 3. Gametogenesis**
  - a. Primordial germ cells
  - b. Different events in gametogenesis
  - c. Oogenesis
  - d. Spermatogenesis & Structure of spermatozoa
- 4. Development of male and female genital system**
- 5. Fertilization**
  - a. Site of fertilization
  - b. Approximation of gametes
  - c. Contact and fusion of gametes
  - d. Effects of fertilization

**Human Physiology (12 hours)**

- 1. Physiology of endocrine glands**
- 2. Sex determination and differentiation**
- 3. Physiology of puberty**
- 4. Physiology of the Male reproductive system**
  - a. Functional anatomy
  - b. Spermatogenesis and its regulations
  - c. Neuroendocrinology
  - d. Semen – composition and its analysis
  - e. Spermatozoa – morphology/ structure
- 5. Physiology of the Female reproductive system**

- a. Functional anatomy
- b. Oogenesis and its regulation
- c. Neuroendocrinology
- d. Female reproductive cycle
  - i. Ovarian cycle
  - ii. Uterine cycle
  - iii. Cervical and vaginal changes
- e. Ovulation and tests for ovulation
- f. Abnormalities of menstrual cycle and menopause
- g. Fertilization and implantation
- h. Placenta – hormones, fetoplacental unit
- i. Pregnancy – physiology & tests

### **Biochemistry (06 hours)**

#### **1. Embryonic Stem Cells and Basics of Stem Cell Therapy**

Origins, Definitions, Characteristics

#### **2. Osmoregulation and Osmotic balance**

#### **3. Lipid metabolism**

- a. Definition, classification, properties and biological importance
- b. Fatty acids, steroids, eicosanoids- chemistry, distribution, classification and functions.
- c. Cholesterol – Synthesis, Fat, derivatives.
- d. Dyslipidemia and associated syndromes associated with infertility.

#### **4. Steroid metabolism**

Classification of hormones, mechanism of action of Steroid hormone

## **Paper 2 - Basic Sciences II**

### **(30 hours)**

#### **Pharmacology (07 hours)**

##### **1. General Pharmacological principles**

- a. Introduction to Pharmacology
- b. Pharmacodynamics and Pharmacokinetics
- c. Drug Metabolism

##### **2. Drugs related to sexual dysfunction and infertility management**

#### **Microbiology (08 hours)**

##### **1. Sterilization**

- a. Autoclave
- b. Incineration
- c. Plasma sterilization
- d. Microwave sterilization

##### **2. Disinfection**

- a. Low level disinfectants and uses
- b. Mid-level disinfectants and uses
- c. High level disinfectants and uses
- d. Disinfection in tertiary care hospital and biosafety cabinet

##### **3. Sexually transmitted diseases and SARS-Cov2**

##### **4. Immunology**

- a. Antigen
- b. Antibody
- c. Vaccines
- d. Immunology of pregnancy

**Pathology (05 hours)**

- 1. Normal Histology – Male and Female reproductive system**
- 2. Male Genital system**
  - a. Cryptorchidism and testicular atrophy
  - b. Inflammatory lesions and neoplasms
  - c. Disorders of Spermatogenesis and Johnson's scoring
- 3. Female genital system**
  - a. Endometriosis
  - b. Endometritis
  - c. Ovarian cysts
  - d. Neoplasms

**Biostatistics and Research methodology (10 hours)**

1. Introduction and data presentation
2. Measures of central tendency and measures of variation
3. Probability and standard distributions
4. Census and sampling methods
5. Inferential statistics
6. Introduction to research methodology
7. Study design – observational studies
8. Experimental studies
9. Uses of epidemiology
10. Application of study design in medical research

## **Paper 3 - Basics of male and female infertility & Genetics (30 hours)**

### **1. Clinical basics (10 hours)**

- a. Definition
- b. Etiology of male and female infertility
- c. Investigation of male and female infertility
- d. Principles of ultrasound
- e. Ultrasound in infertility
- f. Assessment of Ovarian reserve
- g. Treatment options in male infertility
- h. Anovulation – Evaluation and management
- i. Unexplained infertility
- j. Artificial Insemination
  - Indications
  - Types & Procedure
  - Ovarian stimulation and monitoring

### **2. Basic Genetics, gene regulation & disorders (20 hours)**

- a. Basic genetics of the cell
- b. Cell division
- c. DNA Chromatin, Chromosomes
- d. Concept of a gene
- e. Mutations
- f. Epigenetics
- g. Genotype, Phenotype
- h. Basic Mendelian inheritance patterns
- i. Monogenic diseases
- j. Chromosomal abnormalities: numerical, structural
- k. Transcription
- l. Translation
- m. Gene expression
- n. Imprinting disorders
- o. Genetic disorders in infertility
- p. Pedigree analysis
- q. Genetic counseling
- r. Prenatal Diagnosis

## **Paper 4 - Andrology - Clinical basics and Laboratory techniques (60 hours)**

- 1. Spermatogenesis and its disorders**
  - a. Spermatogenesis
  - b. Hormonal regulation of spermatogenesis
  - c. Structure of spermatozoa
  - d. Disorders of spermatogenesis
  
- 2. Semen analysis**
  - a. General principles and characteristics of semen  
Patient instruction  
Physical characteristics  
Nomenclature  
Collection difficulty and management
  - b. Assessment of spermatozoa  
Concentration  
Motility  
Morphology  
Vitality  
Computer Aided Semen Analysis
  - c. Assessment of seminal plasma and its constituents  
Round cells  
Biochemistry of spermatozoa and seminal plasma
  
- 3. Azoospermia**
  - a. Causes
  - b. Types
  - c. Genetic analysis
  - d. Management
  - e. Sperm retrieval techniques
  
- 4. Semen preparation and spermatozoa function tests**
  - a. Semen preparation technique  
Types  
Culture media  
Choice of method for different semen parameters  
Clinical applications
  - b. Special test for spermatozoa function  
Assessment of capacitation

Assessment of acrosome reaction  
Assessment of spermatozoa zona binding  
Sperm mucus interaction tests

c. Sperm DNA fragmentation and detection Tests

**5. Cryopreservation**

a. Basic principles

b. Cryopreservation Techniques

c. Cryopreservation of Spermatozoa and testicular tissue

**6. Setting up of Andrology Laboratory and Quality control/Quality Assurance**

**Second year**  
**Paper 5 - Basics of Clinical Embryology**  
**(30 hours)**

- 1. Folliculogenesis and oogenesis**
  - a. Gonadal differentiation and development
  - b. Folliculogenesis
  - c. Oogenesis
  - d. Oocyte maturation
  - e. Clinical applications
  
- 2. Spermatogenesis**
  - a. Gonadogenesis
  - b. Stages of spermatogenesis
  - c. Clinical applications
  
- 3. Early embryonic development**
  - a. Fertilization
  - b. Zygote
  - c. Cleavage stage embryo
  - d. Blastocyst
  - e. Gene expression in early embryos
  - f. Genomic imprinting
  - g. Epigenetics
  
- 4. Implantation**
  - a. Stages of Implantation
  - b. Molecular biology
  - c. Immunology of implantation and fetal development

# **Paper 6 - ART – Clinical aspects&setting up of Laboratory**

## **(30 hours)**

- 1. Introduction to Assisted Reproductive Technology**
  - a. Assisted Reproductive Technology
    - Definition
    - History
    - Indication
    - Overview
    - Counselling
  
- 2. Ovarian Stimulation in ART**
  - a. Endocrinology of natural and stimulated cycles
  - b. Ovarian stimulation and monitoring in Assisted Reproductive Technology
  - c. Drugs used in Assisted Reproductive Technology
  
- 3. Frozen embryo transfer**
  - a. Indications
  - b. Endometrial preparation and monitoring
  
- 4. Assisted Reproductive Technology - Pregnancy & Outcomes**
  - a. Complications in Assisted Reproductive Technology
  - b. Recurrent implantation failure
  - c. Pregnancy Hormones
  - d. Pregnancy Tests
  - e. Miscarriage
  - f. Extra uterine Pregnancies
  - g. Gestational trophoblastic disease
  - h. Follow up of ART babies
  
- 5. Third party reproduction**
  - a. Semen donation
  - b. Oocyte donation

- c. Embryo donation
- d. Surrogacy
- e. Screening of donors
- f. Semen and Oocyte banking
- g. Social Oocyte freezing
- h. Counseling in Assisted Reproductive Technology

# **Paper 7 – Clinical Embryology and Laboratory techniques**

**(60 hours)**

## **1. Setting up of ART laboratory**

- a. Personnel
- b. Facility, budget & design
- c. Equipment and consumables
  - Laminar flow hoods
  - Incubators
  - Microscopes
  - Laser
  - Disposables used in ART Laboratory
  - Micromanipulator
    - o Types
    - o Micromanipulation components and mechanics
    - o Installing and alignment of micromanipulator

## **2. The Oocyte**

- a. Oocyte retrieval
- b. Oocyte screening
- c. Denudation
- d. Morphology – Normal and Abnormal
- e. Grading
- f. In-vitro maturation

## **3. The Spermatozoa**

- a. Sperm function tests
- b. Sperm preparation methods

## **4. IVF- In Vitro Fertilization**

- a. Handling and manipulation of gametes and embryos
- b. Media and dish preparation
- c. Conventional IVF - Procedure
- d. Gamete and embryo culturing technique

**5. ICSI - Intra Cytoplasmic Sperm Injection**

- a. Dish preparation
- b. Sperm selection & immobilization
- c. ICSI- Procedure

**6. Early embryo development**

- a. Sperm-oocyte interaction
- b. Fertilization & cleavage
- c. Fertilization Failure
- d. Artificial Oocyte Activation

**7. Embryo culture**

- a. Types and Constituents of culture media
- b. Culture system
- c. Dish preparation
- d. Embryo culture methods

**8. Embryo quality assessment**

- a. Embryo morphology & cleavage assessment
- b. Embryo grading till Blastocyst

**9. Biopsy**

- a. Polar body biopsy
- b. Cleavage stage embryo biopsy
- c. Blastocyst biopsy
- d. Tubing techniques
- e. Clinical application

**10. Embryo transfer**

- a. Consumables
- b. Loading techniques
- c. Embryo transfer techniques

## **11. Cryobiology**

- a. Basic principles
- b. Cryoprotectants
- c. Carrier device
- d. Cryopreservation techniques
- e. Cryopreservation and thawing of Ejaculated and testicular spermatozoa
- f. Oocyte cryopreservation and thawing
- g. Embryo cryopreservation and thawing
- h. Ovarian tissue cryopreservation and transplantation
  - Indication
  - Techniques

## **12. Quality Assurance/Quality Control**

- a. Lab Environment – including Air quality, temperature, humidity
- b. Troubleshooting in ART
- c. Quality control in Assisted Reproductive Technology lab
  - Lab personnel
  - Equipment
  - Consumables
- d. Documentation and record maintenance
- e. Biomedical waste management
- f. Staff safety protocols

## **Paper 8 - Recent advances, Fertility preservation and Ethics**

**(30 hours)**

### **1. Molecular and Genetic assessment**

- a. Proteomics and metabolomics
- b. Preimplantation Genetics Testing (PGT)
  - i. Preimplantation Genetic Testing for Aneuploidy(PGT-A)
  - ii. Preimplantation Genetic Testing for Monogenic disorders(PGT-M)
  - iii. Preimplantation Genetic Testing for Structural Rearrangements (PGT-SR)

### **2. Modalities for Genetic analysis**

- a. Genetic karyotyping
- b. Principles of PCR- Polymerase Chain Reaction
- c. Fluorescent In Situ Hybridization (FISH)
- d. NGS (Next Generation Sequencing)
- e. CGH (Comparative Genomic Hybridization)

### **3. Advanced techniques in Assisted Reproductive Technology**

- a. Stem cell technology- Types, Origin, Characteristics and Clinical Application
- b. Cloning
- c. Gene Editing (Designer babies)
- d. Automated IVF
- e. Time lapse imaging of embryos
- f. Advanced micro assisted fertilization techniques
- g. Assisted hatching
- h. Advanced sperm selection techniques ( IMSI , PICSI , Microfluidics , MACS)

### **4. Fertility preservation**

- a. Indications and methods in men
- b. Indications and methods in women
- c. Indications and methods in children

- d. Stimulation protocols
- e. In vitro follicular culture
- f. Tissue culture techniques

**5. Ethics**

- a. Regulations and licensing
- b. Third party reproduction
- c. ART guidelines – ICMR, ASRM, SART, ESHRE, HFEA, NICE

## Practical

Wherever necessary observation of the procedures and demonstrations will be carried out, like

### First year

1. General laboratory practice and guidelines
2. Semen analysis
3. Sperm preparation techniques
4. Hypo-osmotic swelling test & vitality test
5. Fructose Test
6. Semen freezing and thawing
7. Sperm DNA fragmentation test
8. Equipment & disposables
9. Documentation and record maintenance

### Second year

1. Good laboratory practices
2. Equipment and disposables
3. Basic ultra sound observation
4. Follicular monitoring observation
5. Male infertility - investigation observation
6. Case discussion
7. Observation of ART procedures
8. Media incubation
9. Dish preparation
10. Micromanipulator – calibration and alignment
11. Sperm immobilization
12. Conventional IVF
13. ICSI
14. Embryo culture
15. Embryo grading
16. Oocyte & Embryo vitrification and thawing
17. Air quality
18. Sperm retrieval technique observation
19. Embryo transfer technique observation
20. Troubleshooting