

## **M.Sc. (Reproductive Biology & Clinical Embryology)**

### **ACADEMIC SCHEDULE**

Theory (Didactic) Lectures + Seminars + Journal Clubs – Semester I & II (2 hours / day)

Practicals (Hands-on + Demo) – Semester I & II (first half) (4-5 hours / day)

Project + Dissertation – Semester II (later half), III & IV (first half)

[Thesis submission in Jan. end of 2<sup>nd</sup> Year]

Seminars + Revision of Practical – Semester IV (later half)

	Semester I	Semester II	Semester III	Semester IV
Lectures	←————→			
Practicals (Hands-on + Demo)	←————→			←————→
Dissertation		←————→		
Seminars / Journal Clubs	←————→			

### **EVALUATION**

Internal Assessment : Max. Marks = 500

Semester I & II (Theory) 150

Semester I & II (Practicals) 50

Dissertation (Experimental) 200

Dissertation (Thesis) 100

External Assessment : Max. Marks = 500

Theory Paper 1 100

Theory Paper 2 100

Theory Paper 3 100

Practical Exam (Hands-on) 100

Practical Exam (Viva) 100

## **THEORY (3 papers)**

### **Paper 1**

- A. Basics of biochemistry, molecular & cell biology
- B. Reproduction & embryology
- C. Reproductive anatomy

### **Paper 2**

- A. Reproductive physiology
  - a. Physiology – Male & Female
  - b. Endocrinology – Hormones, their regulation, disorders
  - c. Immunology – Basics & disorders
  - d. Toxicology

### **Paper 3**

- A. Reproductive disorders
- B. Assisted reproductive techniques & Recent advances
- C. Lab techniques – Principles & Instrumentation
- D. Research methodology – Quality control; Research ethics; Scientific writing
- E. Biostatistics
- F. Ethics; Regulatory laws & guidelines

## **PRACTICALS**

### **1. Genetic Manipulation / Nucleic Acid-related Techniques**

- A. Isolation of genomic DNA
- B. Isolation of RNA and cDNA preparation
- C. Amplify DNA by PCR
- D. Agarose gel electrophoresis
- E. Cloning of DNA into plasmid
- F. Transformation of plasmid into bacteria

### **2. Protein-related Techniques**

- A. 1-D SDS-PAGE
- B. 2-D PAGE
- C. Western Blotting

### **3. Cell Biology Techniques**

- A. Cell line culture & maintenance
- B. Phase contrast microscopy / photography
- C. Bright-field & fluorescence microscopy
- D. Immunocytochemistry
- E. Transfection of cell line

#### **4. Immunobiology Techniques**

- A. Radioimmuno assay (RIA)
- B. Enzyme linked Immuno Assay (ELISA)
- C. Chemiluminescent Immunoassay (CMIA) Automated – Demo only

#### **5. Molecular Cytogenetics Techniques**

- A. Karyotyping
- B. Fluorescent In Situ Hybridization (FISH)
- C. PCR & Real-Time PCR
- D. QF-PCR / Genetic Analyzer

#### **6. Reproductive Biology Techniques (Mouse model)**

- A. Super-ovulation
- B. Isolation of oocytes and sperm from mice
- C. In Vitro Fertilization (IVF)
- D. Culture of zygote to blastocyst stage
- E. Mating & checking copulation plug
- F. Collection & isolation of pre-implantation embryo
- G. In vitro maturation of GV-stage oocytes
- H. Intra-Cytoplasmic Sperm Injection (ICSI) / Micromanipulation
- I. Sperm / oocyte / zygote cryopreservation
- J. Semen analysis – Manual & CASA; Sperm capability
- K. Human IVF lab – **Rotation & Demo only**

#### **7. Reproductive Biology Techniques (Human)**

- A. Semen analysis – Manual & CASA; Sperm capability
- B. Human IVF lab – **Rotation & Demo only**

#### **Note:**

Ethical clearance as required will be taken from Animal ethics committee before conducting the animal-related practicals.

For dissertation work also, required ethical clearance will be taken before-hand from Animal ethics committee (in case of mice-related projects) or Institutional ethics committee (in case of human-related projects) as applicable.

## **LECTURES**

### **PAPER 1**

#### **A. Basics of Biochemistry, Molecular & Cell Biology**

Structure of the building blocks – Proteins, Carbohydrates, Nucleic acids, Lipids

Enzymes – How Enzymes Work; Enzyme Kinetics

Biological Membranes and Transport

Bioenergetics and Biochemical Reaction Types

Carbohydrate metabolism – Glycolysis, Krebs's cycle, Gluconeogenesis

Lipid Biosynthesis & Fatty Acid Catabolism

Biosynthesis of Amino Acids, Nucleotides, and Related Molecules

Amino Acid Oxidation and the Production of Urea

DNA Replication; Mutations & Repair Mechanisms; Recombination

Transcription – Synthesis of RNA; RNA Processing; Regulation

Translation – Mechanism; Regulation

Protein Metabolism – Synthesis; Targeting and Degradation

Regulation of Gene Expression

Hormonal Regulation and Metabolism

Cell organization; Intracellular compartments

Cytoskeleton & Cell Dynamics

Cell junctions; Cell adhesion; Extracellular Matrix; Cell migration

Cell signaling – Typical ligand-receptor systems; Intracellular signaling systems;  
Signal transduction

Cell growth & Division – Basic mechanism of mitosis & apoptosis

Oncogenes, Tumor Suppressor Genes, and Programmed Cell Death

Overview of Molecular Genetics; Cytogenetics & Molecular cytogenetics

Epigenomics; Gene cloning; Gene therapy

#### **B. Reproduction & Embryology**

Gametogenesis: Conversion of germ cells into male gametes

Gametogenesis: Conversion of germ cells into female gametes

Ovulation (ovarian cycle, menstrual cycle)  
Fertilization  
Implantation  
Bilaminar germ disc  
Trilaminar germ disc  
The embryonic period (overview)  
The fetus  
The fetal membranes and placenta  
Birth defects and prenatal diagnosis  
Development of male reproductive system I (Gonads, genital ducts, glands)  
Development of male reproductive system II (External genitalia, descent of testis)  
Development of female reproductive system I (Gonads, genital ducts, glands)  
Development of male reproductive system II (External genitalia, descent of ovaries)

### **C. Reproductive Anatomy**

Male reproductive system (gross anatomy, neuroendovascular supply)  
Female reproductive system (gross anatomy, neuroendovascular supply)

## **PAPER 2**

### **A. Reproductive Physiology (Including clinical correlates)**

Mechanism of action of hormone and receptor concerned with reproduction  
Neuroendocrine control of reproduction and feedback mechanism  
Hormones: gonadotropins, prolactin, melatonin  
Hormones: Estrogen, progesterone, testosterone  
Hormones: Inhibin B, AMH, Activin, Leptin, etc  
Hormones: T3, T4, TSH, Cortisol, DHEA  
Metabolic control of reproduction  
Physiology of Pregnancy, parturition and lactation  
Basics of immune system  
Immunophysiology of male and female reproduction

Immunology of pregnancy

Pubertal changes

Reproductive Ageing – Menopause; Andropause

Sexual behavior – Male & Female

Epigenetics of reproduction

Methods of fertility regulation in male and female

Prevention of sexually transmitted diseases and Reproductive health

Reproductive toxicology

### **PAPER 3**

#### **A. Reproductive Disorders**

Sexual differentiation & developmental abnormalities – male & female

Menstrual disorders – Precocious, delayed or absent puberty; Amenorrhea

Fertility disorders – Sexual dysfunction; Infertility; Spontaneous pregnancy loss

Pregnancy disorders – Pre-eclampsia, IUGR, Labour abnormalities

Endocrine disorders – Hyperprolactinemia

Autoimmune disorders

Genetic disorders (mutations and syndromes)

Cancers and biomarkers – Testicular; Prostate; Ovarian; Endometrial; Cervical;  
Breast

Reproductive pathology

#### **B. Assisted Reproductive Techniques & Recent Advances**

Semen analysis

Ovulation induction; Oocyte retrieval; In vitro maturation

In vitro fertilization

ICSI, GIFT etc.

Cryopreservation of gametes & embryos; Vitrification

Embryo biopsy; Embryo hatching

Pre-implantation genetic diagnosis (PGD)

Stem cells & therapeutic cloning

### **C. Lab Techniques – Principles & Instrumentation**

Basic instrumentation – pH meter; Centrifuges; Microscopes; Electrophoresis

Genetic manipulation / Nucleic acid techniques – DNA & RNA isolation; PCR etc.

SDS-PAGE & Western blotting

Cell biology techniques – Cell culture; Transfection etc.

Immuno techniques – RIA; ELISA; CMIA

Molecular Cytogenetics techniques – FISH; Karyotyping; Microarray; PRINS; QF-PCR; Array CGH; MLPA etc.

### **D. Research methodology – Quality control; Research ethics; Scientific writing**

#### **E. Biostatistics**

Introduction to Biostatistics - scope & need for the application of statistical methods in medical and biological data

Definition of different terms in statistical methods - Scale of measurements; Methods of data collection

Presentation of data - statistical tables, diagrams and graphs; Needs for reduction of data - measures of average and location

Measures of dispersion - Range, quartile deviation, mean deviation and standard deviation; Concepts of statistical population and sample - need for sampling studies, Simple procedures of random sampling; Methods of sampling

Probability: Basics concepts and theorems of probability

Standard error, estimation and testing the statistical significance; Test of significance: Normal deviate test (Z test); Student's t tests; Chi-Squared tests; F - Test and one way analysis of variance and multiple range tests; Two way analysis of variance and multiple range test; Non- Parametric statistical methods; Correlation - definition and application; Regression - definition and application; Statistical methods in Diagnostic Tests

#### **F. Ethics; Regulatory laws & Guidelines**

Ethical practices

National & International guidelines for ART

Laws regulating gamete donors & surrogacy