

CHETTINAD ACADEMY OF RESEARCH & EDUCATION

(Deemed to be University under section 3 of the U.G.C. Act 1956)



M.Sc CLINICAL EMBRYOLOGY 2022 - 23

REGULATIONS & SYLLABUS

M.Sc. CLINICAL EMBRYOLOGY
(Regulations & Syllabus)

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GOAL

The goal of postgraduate M.Sc. in Clinical Embryology shall be to train and produce competent Clinical Embryologists who will be well versed in handling clinical embryological procedures, academics and research activities.

OBJECTIVE

1. Demonstrate comprehensive knowledge and understanding of gross and microscopic structure of the human cell and its organelles.
2. Comprehend normal anatomy and physiology of the male and female reproductive system.
3. Develop a basic understanding of biochemistry, endocrinology and pharmacology.
4. Demonstrate knowledge of basic and systemic embryology including human genetics, genetic inheritance, gene regulation, immunology and stem cell therapy.
5. Understand the basic concept of Assisted Reproductive Techniques (ART).
6. Independently handle semen and its processing for both techniques – Intra Uterine Insemination (IUI) and In-Vitro Fertilization (IVF)/ Intra Cytoplasmic Sperm Injection (ICSI).
7. Be able to process spermatozoa obtained from Spermatozoa Retrieval Techniques.
8. Should be able to identify and handle human oocyte in the embryology laboratory.
9. Assess viability of embryos and their developmental competence with fair accuracy.
10. Cryopreserve human gametes and embryos, thaw them and subsequently develop them to transfer into the uterus.
11. Should be well versed in setting up of Andrology & Embryology laboratory according to the current standards and maintain proper quality control measures.
12. Should be well versed in current guidelines, documentation and record maintenance.
13. Should be able to carry out research dissertations, present poster/ paper in conferences and publish articles in scientific journals.

COMPONENTS OF THE COURSE CURRICULUM

The major components of the postgraduate curriculum shall be:

- Theoretical knowledge
- Practical skills
- Counseling skills
- Research and Publications - Thesis skills
- Attitude including communication skills
- Training in research methodology
- Documentation and record maintenance.

1. BRANCH OF STUDY

Post Graduate Degree Course in M.Sc. (Clinical Embryology)

2. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the post graduate Degree Courses in M.Sc. Clinical Embryology must have passed any of the following from a university recognized by UGC

- Bachelor's or Master's degree in Life Sciences, (or) Bachelor's or Master's degree in Veterinary science (or)
- Medical graduates - MBBS
- Bachelor's or Master's degree in Biotechnology

3. AGE LIMIT FOR ADMISSION

There is no upper age limit for admission to this course.

4. MIGRATION

No student, once admitted to the course and enrolled by the University, will be permitted to migrate to any other Course/ University.

5. ELIGIBILITY FOR FACULTY

Faculty eligible for training students for M.Sc. Clinical Embryology:

- Ph D in Clinical Embryology
- Ph D in Reproductive Medicine with a teaching experience of 3 years minimum in the field of ART
- Masters in Clinical Embryology
- PGDCE with a teaching experience of 5 years minimum
- MD/MS/DNB/Diploma in Obstetrics and Gynaecology with a Fellowship degree in Reproductive Medicine and a teaching experience of 3 years minimum in the field of ART

6. APPOINTMENT OF EXAMINERS

There shall be at least two examiners in practical examination. Out of them one shall be external examiner and one shall be internal examiner. Eligibility criteria for the examiner:

- Ph D in Clinical Embryology with a teaching experience of 3 years
- Ph D in Reproductive Medicine with a teaching experience of 5 years minimum in the field.
- Masters in Clinical Embryology with a teaching experience of 3 years.
- PGDCE with a teaching experience of 7 years minimum.
- MD/MS/DNB/Diploma in Obstetrics and Gynaecology with a Fellowship degree in Reproductive Medicine and a teaching experience of 5 years minimum.

7. DURATION OF THE COURSE

The duration of the course shall be for a period of 2 years for all students.

8. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be in English.

9. METHODS AND PLACE OF TRAINING

Students will be trained in the Department of Reproductive Medicine & Andrology and the Basic Sciences Departments of Chettinad Hospital & Research Institute. Training includes involvement in laboratory and experimental work, and research studies. The postgraduate students shall actively participate in departmental seminars and journal reviews. Exchange programme with other centers of excellence may be provided for a period of 15 days in the beginning of 2nd year.

10. COMMENCEMENT OF THE PROGRAM

The program shall ordinarily commence in 1st August of the Academic year. Admission to the program shall be completed by 31st August.

11. NO OF WORKING DAYS

Each academic year shall have a total minimum of 200 working days.

12. ATTENDANCE

Candidates shall have attended not less than 80% attendance in theory and clinical training separately to be eligible to appear for the University examinations. Candidates lacking in prescribed percentage of attendance in theory and clinical training in a subject will not be eligible to appear for final examination in that subject. However, candidate shall put in required attendance in subsequent term and appear for the examination.

12(A) CONDONATION OF LACK OF ATTENDANCE

The discretionary power of Condonation of shortage of attendance to appear for University Examination rests with the Vice Chancellor.

Lack of attendance can be condoned up to a maximum of 5% of the minimum attendance required in the following exceptional circumstances:

- (i) Any illness/ accident (for which medical certificate from a registered medical practitioner must be produced)
- (ii) Any unforeseen tragedy in the family (should produce the letter from the parent/guardian)
- (iii) Participation in NCC/NSS and other co-curricular activities representing the Institution / University (Certificate from competent authority is required).

For any of the above reasons, request shall be made by the candidate with prescribed fees to the Controller of Examination through proper channel, ten days prior to the commencement of the theory examination. Based on the recommendation of the Class In-charge concerned and the Head of the Department, the Controller of Examination shall obtain the approval of the Vice Chancellor for admission of the candidate to the University Examination.

13. INTERNAL ASSESSMENT

There shall be minimum of two internal assessment tests in theory and two practical internal assessments for every year, the average of the tests will be calculated and submitted to the Chettinad University at least 15 days before the commencement of university examination. The records and marks obtained in such tests will be

maintained by the Head of the Department. A minimum of 50% marks in the internal assessment tests will be considered as eligibility criteria to appear for the university examination.

14. SUBJECTS AND HOURS OF TEACHING FOR THEORY AND PRACTICALS

Table I: Distribution of Subjects and Teaching Hours (FIRST YEAR)

S.No	Paper	Subjects	Hours of teaching
1	Paper 1	Basic Sciences I: Anatomy, Human Physiology, Biochemistry	30 Hrs
2	Paper 2	Basic Sciences II: Pathology and Pharmacology, Microbiology & Statistics	30 Hrs
3	Paper 3	Basics of male and female infertility & Genetics	30 Hrs
4	Paper 4	Andrology - Clinical basics & Laboratory Techniques	60 Hrs

Table II: Distribution of Subjects and Teaching Hours (SECOND YEAR)

S.No	Paper	Subjects	Hours of teaching
1	Paper 5	Basics of Clinical Embryology	30 Hrs
2	Paper 6	ART - Clinical aspects & setting up of Laboratory	30 Hrs
3	Paper 7	Clinical Embryology & Laboratory techniques	60 Hrs
4	Paper 8	Recent advances, Fertility preservation & Ethics in Assisted Reproduction	30 Hrs

Total hours of clinical training for First year – 100 hours

Total hours of clinical training for Second year – 200 hours

15. DISSERTATION

Every candidate pursuing M.Sc. Degree Course is required to carry out work on a selected research dissertation under the guidance of a recognized post graduate teacher in their respective subjects. The results of such work shall be submitted in the form of dissertations.

The dissertation is aimed to train a post graduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, comparison of results and drawing conclusions.

Every candidate shall submit a synopsis in the prescribed format containing particulars of proposed dissertation work within nine months from the date of commencement of the course.

The synopsis shall be sent through the proper channel, such synopsis will be reviewed by the IRB and IHEC/IAEC as applicable. No change in the topic or guide shall be made without prior approval of the University.

The candidate shall report the progress of the dissertation work to the concerned guide periodically and obtain clearance for the continuation of the dissertation work. The dissertation should be written under the following headings

- i. Introduction
 - ii. Aim and Objectives of study
 - iii. Review of Literature
 - iv. Materials and Methods
 - v. Results
 - vi. Discussion
 - vii. Conclusion
 - viii. Summary
 - ix. References
 - x. Tables
- xi. Annexure
- Four copies of dissertation thus prepared shall be submitted 15 days before the date of final University examination. This will be considered as an eligibility criterion for appearing for the university examinations. The dissertation shall be valued by the examiners appointed by the University on the day of practical examination. Approval of dissertation work is an essential prerequisite for a candidate to obtain the degree. In case the dissertation is not accepted, the candidate has to make the suggested changes and resubmit the dissertation for evaluation and acceptance, until which the award of degree will be withheld.

16. ELIGIBILITY FOR APPEARING FOR UNIVERSITY EXAMINATION

- The candidate should have a minimum of 80% attendance as mentioned in clause 12.
- Four copies of dissertation shall be submitted 15 days before the date of final University examination.
- The candidate should have obtained a minimum of 50% in the internal assessment.

17. SCHEDULE FOR EXAMINATION

There shall be two sessions of university examinations in an academic year September (Main) and supplementary examination in March for M.Sc. Clinical Embryology at the end of every year.

Paper-wise distribution of marks for First year

S.No	Paper	Subjects	Maximum marks	
			Theory	Internal assessment
1	Paper 1	Basic Sciences I: Anatomy & Physiology, Biochemistry	80	20
2	Paper 2	Basic Sciences II: Pathology, Pharmacology, Microbiology & Statistics	80	20
3	Paper3	Basics of male and female infertility & Genetics	80	20
4	Paper 4	Andrology - Clinical basics & Laboratory Techniques	80	20
5	Practical examinations for Andrology		40	20
6	Viva voce and spotters		40	

Paper-wise distribution of marks for Second year

S.No	Paper	Subjects	Maximum marks	
			Theory	Internal assessment
1	Paper 5	Basics of Clinical Embryology	80	20
2	Paper 6	ART - Clinical aspects & setting up of Laboratory	80	20
3	Paper 7	Clinical Embryology & Laboratory techniques	80	20
4	Paper 8	Recent advances, Fertility preservation & Ethics in Assisted Reproduction	80	20
5	Practical examinations		40	20
6	Viva voce and spotters		40	
7	Dissertation		Accepted/ Not accepted	

18. QUESTION PAPER PATTERN

There shall be a written University examination at the end of each year. Each paper carries 80 marks. The First and Second year theory papers carry a maximum of 80 marks. There shall be a practical examination for a maximum of 80 marks including Viva voce at the end of First and Second year. The question paper will be set by the course teacher/external faculty.

Theory paper

	Question Paper pattern	
Section A	2 Essay questions	10 marks each (2 x10) = 20 marks
Section B	6 Short notes questions	5 marks each (6 x 5) = 30 marks
Section C	10 Brief answer questions	2 marks each (10 x 2) = 20 marks
Section D	10 MCQ's	1 mark each (1x10)= 10 marks
	Total	80 marks

19. PRACTICAL EXAMINATION

The practical examinations shall be aimed at assessing competence and skills in techniques and procedures as well as testing students' ability to make relevant and valid observations, interpretations and inference of laboratory or experimental work related to the subject.

PATTERN FOR PRACTICAL EXAMINATION

First year

Subjects	Particulars	Maximum Marks
Andrology	Semen Analysis	15
	Sperm Preparation	25
Spotters/Images		20
Viva Voce		20
Total		80

Second year

Subjects	Particulars	Maximum Marks
Embryology	Dish preparation	05
	Needle Alignment	15
	Spermatozoa Immobilization	15
	Freezing and thawing	10
Spotters/Images		15
Viva Voce		20
Total		80

Total marks for Practical and Viva voce in First Year = 80 marks

Minimum for a pass = 40 marks (Practical including Viva)

Total marks for Practical and Viva in Second Year (for all papers) = 80 marks

Minimum for a pass = 40marks (Practical including Viva)

Internal assessment = minimum 50% in each theory paper and practical examinations for both years.

20. CRITERIA FOR DECLARING AS PASS IN UNIVERSITY EXAMINATION

For declaring as pass in the University examination, the candidate shall secure a minimum of 50% marks in theory, 50% in IA and 50% marks in practical examinations (including viva voce) in the First and Second year. A candidate securing less than 50% of marks either in theory or practical component as described above shall be declared to have failed in the examination. Failed candidate may appear in any subsequent examination upon payment of fresh fee. Those candidates who fail in one or more subjects shall have to appear only in the subject so failed, in the subsequent examinations.

21. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Marks scored	Classification
75% and above	First class with Distinction
65% to 74%	First class
50% to 64%	Pass class

Distinction and 1st class will be awarded only for candidates passing the examination in the first attempt.

22. CARRY OVER OF FAILED SUBJECTS

A candidate who fails in any paper in the First year shall be permitted to carry those subjects up to Second year. The candidate may appear for the successive supplementary examination as per the university norms. However, the candidate must pass the carry over subjects before appearing for the Second-year examination.

23. AWARD OF DEGREE

A candidate, who has passed all the subjects of both years and his/her dissertation has been accepted, shall be eligible for award of Degree.

24. DURATION FOR COMPLETION OF THE COURSE OF STUDY

The maximum duration for the completion of the course shall be fixed as double the actual duration of the course and the students have to pass within the said period, otherwise they have to get fresh Registration.

25. RE-ADMISSION AFTER BREAK OF STUDY

Candidate who seeks re-admission to the course after break of study has to get the approval from the Chettinad University by paying a Condonation fee. Condonation orders for break of study will be issued only once during the entire duration of the course. The total period for completion of the program reckoned from the commencement of the program to which the candidate was first admitted shall not exceed the maximum period specified in clause 24 of this Regulations irrespective of the period of break of study granted to him/her to qualify for the award of degree.

26. REVALUATION / RETOTALLING OF ANSWER PAPERS

There is no provision for revaluation of the answer papers of failed candidates in any examination. However, the failed candidates can apply for re-totaling.

SCHEME OF EXAMINATION
M.Sc. Clinical Embryology
First Year

S. Code	Paper	Subjects	Hours Per Year		Evaluation (Marks)									
					Internal Assessment				University Exam					
			Practical	Theory	Practical		Theory		Theory		Practical		Total Secured	
					Min	Max	Min	Max	Min	Max	Min	Max	Theory + Internal Assessment	Practical + Viva
	Paper 1	Basic Sciences I Anatomy, Physiology & Biochemistry	-	Each 30 hours	-	-	10	20	40	80	-	-		
	Paper 2	Basic Sciences II Pathology, Pharmacology, Microbiology & Statistics	-	Each 30 hours	-	-	10	20	40	80	-	-		
	Paper 3	Basics of male and female infertility & Genetics	20 hours	Each 30 hours	-	-	10	20	40	80	-	-		
	Paper 4	Andrology - Clinical basics & Laboratory Techniques	80 hours	60 hours	-	-	10	20	40	80	-	-		
Andrology - Practical examination & Viva					10	20	-		-		40	80		

SCHEME OF EXAMINATION
M.Sc. Clinical Embryology
Second Year

S.Code	Paper	Subjects	Hours Per Year		Evaluation (Marks)									
					Internal Assessment				University Exam					
			Practical	Theory	Practical		Theory		Theory		Practical		Total Secured	
					Min	Max	Min	Max	Min	Max	Min	Max	Theory + Internal Assessment	Practical + Viva
	Paper 5	Basics of Clinical Embryology	40 hours	30 hours	-	-	10	20	40	80	-	-		
	Paper 6	ART - Clinical aspects & setting up of Laboratory	20 hours	30 hours	-	-	10	20	40	80	-	-		
	Paper 7	Clinical Embryology & Laboratory techniques	100 hours	60 hours	-	-	10	20	40	80	-	-		
	Paper 8	Recent advances, Fertility preservation & Ethics in Assisted Reproduction	40 hours	30 hours	-	-	10	20	40	80	-	-		
Embryology - Practical examination & Viva					10	20	-				40	80		
Dissertation (Accepted/Not accepted)														

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 and female infertility
- h. An ovulation – Evaluation and management
- h. Unexplained infertility
- i. 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. Epigenetic
- g. Genotype, Phenotype
- h. Basic Mendel an 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. Hormone regulation for 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 capacitating
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
- b. Overview and Divisions of embryology

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 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
- i. Follow up of ART babies

**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. Oocyte retrieval & Sperm selection

- a. Oocyte retrieval and oocyte morphology
- b. In Vitro oocyte Maturation
- c. Spermatozoa evaluation
 - Sperm function tests
 - Sperm selection methods

3. Early embryo development

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

4. IVF- In Vitro Fertilization

- a. Handling and manipulation of gametes and embryos
- b. Media and dish preparation
- c. Oocyte and embryo grading
- d. Gamete and embryo culturing technique

5. ICSI - Intra Cytoplasmic Sperm Injection

- a. Dish preparation
- b. Oocyte screening
- c. Denudation
- d. Sperm selection & immobilization
- e. ICSI- Procedure

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

- 7. Embryo quality assessment**
 - a. Embryo morphology and cleavage assessment
 - b. Embryo grading till Blastocyst

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

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

- 10. 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

- 11. 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 karyo typing
- 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. Micro fluidics
- g. Advanced micro assisted fertilization techniques
- h. IMSI-Intracytoplasmic morphologically selected sperm injection
- i. PICSI-Physiological intracytoplasmic sperm injection
- j. Assisted hatching

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. Good laboratory practices and guidelines
2. Semen analysis
3. Sperm preparation techniques
4. Hyper osmotic saline 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 and guidelines
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 verification and thawing
17. Air quality
18. Sperm retrieval technique observation
19. Embryo transfer technique observation
20. Troubleshooting