



Avinashilingam Institute for Home Science and Higher Education for Women
Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD
Re-accredited with 'A++' Grade by NAAC.CGPA 3.65/4, Category I by UGC
Coimbatore-641043, TamilNadu, India

Department of Clinical Embryology
M.Sc. Clinical Embryology

Programme Outcomes:

1. Acquiring enhanced knowledge on the theoretical and practical aspects of embryology. Understanding about embryology counselling and acquiring communication skills
2. Learning all theoretical aspects of human development from gamete formation, ovulation, fertilization, pre and post- implantation events.
3. Acquiring hands on skills of the diagnostic sperm tests and procedures performed in an ART unit ranging from sperm preparation to oocyte aspiration to ICSI.
4. Understanding the working, maintenance ,calibration of equipments in an IVF unit and Analyzing the KPI's and maintaining records/documents as per government norms..
5. Enhancing analytical and trouble shooting skills required for the successful functioning of an ART unit and applying advanced professional ethics in clinical and laboratory practices.
6. Learning the nuances of setting up and working in an ART laboratory. Understanding the government regulations required for running an IVF unit – level 1 and 2/ART bank.

Programme Specific Outcomes:

1. Developing hands-on skills in the various procedures performed in an IVF unit.
2. Ability to relate and connect concepts of professional ethics and values in clinical embryology and its application.
3. Complete understanding about all the laboratory aspects required for an ART unit.

Scheme of Instruction and Examination

(For students admitted from 2025 – 2026 & onwards)

Part	Subject Code	Title of the Paper / Component	Hrs of Instruction /Week		Scheme of Examination				
			T	P	Duration of Exam	CIA	CE	Total	Credits
First Semester									
I	25MCEC01	Cell Biology and Reproductive Genetics	5	-	3	40	60	100	5
I	25MCEC02	Human Infertility	5	-	3	40	60	100	5
I	25MCEC03	Examination and Processing of Human Semen	5	-	3	40	60	100	5
I	25MCEC04	Andrology Laboratory and IUI (Intrauterine Insemination)	5	-	3	40	60	100	5
I	25MCEC05	Semen Analysis -Practical I	-	4	3	40	60	100	2
I	25MCEC06	Sperm Processing Techniques-Practical II	-	4	3	40	60	100	2
II		Medical Camp	2	-	-	-	-	-	-
Second Semester									
I	25MCEC07	Laboratory Insights	5	-	3	40	60	100	5
I	25MCEC08	Embryo Culture Systems	6	-	3	40	60	100	6
I	25MCEC09	Clinical Applications for Invitro Procedures	5	-	3	40	60	100	5
I	25MCEC10	Cryopreservation of Sperm-Practical III	-	4	3	40	60	100	2
I	25MCEC11	Media Aliquoting- Practical IV	-	4	3	40	60	100	2
II		Professional Certificate Course	-	-	-	-	-	-	2
II		Inter disciplinary Course	4	-	3	100		100	4
II	25MSXMC1	Medical Camp	-	2	2	-	-	100	2
Internship during Summer Vacation for One Month									
Third Semester									
I	25MCEC12	Micromanipulation, Fertilization, Zygote and Embryo Assessment	6	-	3	40	60	100	6
I	25MCEC13	Choosing the Right Embryo and Chromosomal Abnormalities (Self Study)	2	-	3	40	60	100	2
I	25MCEC14	Oocyte Handling – Practical V	-	4	3	40	60	100	2
I	25MCEC15	Intra Cytoplasmic Sperm Injection (ICSI) and Invitro Fertilization(IVF) Insemination - Practical VI	-	4	3	40	60	100	2
I	25MCEC16	Zygote / Embryo Grading and Culture - Practical VII	-	4	3	40	60	100	2

I	25MCEC17	Embryo and Oocyte Cryopreservation -Practical VIII	-	4	3	40	60	100	2
I	25MCEC18	Mini Project	-	1	-	100	-	100	2
I	25MCEC19	Internship	-	-	-	-	-	100	2
II	25MCEPD1	Professional Development course - Current Advances in Assisted Reproductive Technology	3	-	-	100	-	-	Remarks
II		Multidisciplinary Course	2	-	3	100	-	100	2
Fourth Semester									
I	25MCEC20	Laser Hatching and Embryo Biopsy –Practical IX	-	4	3	40	60	100	2
I	25MCEC21	Research Project	-	26	-	100	100	200	20
Total Credits									96

Other courses to be undergone by the student:

Other course to be undergone by the students:

MOOC course– 2to 4 credits

Note: Minimum 96+2 to 4credits to earn the degree

**** Students who exit at the end of 1st year shall be awarded a Postgraduate Diploma.**

Cell Biology and Reproductive Genetics

Semester I
25MCEC01

Hours of instruction/week: 5
No. of Credits: 5

Course Objectives: To enable students to

1. Understand the basics of cells and reproductive cells
2. Application of genetics in the field of reproductive medicine
3. Complete understanding of the basics of reproduction

Unit 1: Cell Biology

15 hours

Nature and function of cells – Cell membrane – Internal membranes – Nucleus – Mitochondrion and chloroplast – Cytoskeleton – Cell matrix and cell to cell communication – Mitosis and meiosis – Evolution of cells – Cell theory – oogenesis and spermatogenesis

Unit 2: Female reproductive system

15 hours

Reproductive organs: ovaries, uterine tubes, uterus, vagina - Regulation and physiology of menstrual cycle – Endocrinology – Hormones involved in folliculogenesis - Folliculogenesis

Unit 3: Male reproductive system

15 hours

Reproductive organs: scrotum, testis, epididymis, ductus deferens, seminal glands, ejaculatory duct, penis – Endocrinology of testicular function

Unit 4: Genetics

15 hours

DNA structure – RNA structure – Mendelian genetics: modes of inheritance – Patterns of inheritance

Unit 5: Genetics in Infertility

15 hours

Genetics of male infertility – Genetics of female infertility — Preimplantation genetic diagnosis and screening - Male and female genetic disorders

Total hours: 75

Reference Books:

1. Kamini.A.Rao (2023), 3rd edition, Principles and Practices of ART – Volume 1
2. Rastogi (2019) Genetics, 4th edition

3. P. Vogt (2017), Genetics of Human infertility
4. Rastogi (2003), 2nd edition, Cell and molecular biology

Course outcomes:

1. Learn the basics of cell biology.
2. Understand cell biology and its relevance in the reproduction field.
3. Acquire knowledge on the basics of genetics.
4. Understand molecular genetics with relevance to sex and inheritance.
5. Recognize the relevance of genetics in infertility.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	M	H	M					M	M
CO 2	M	H	H		M		L	M	L
CO 3	L	H	H		M		M	L	M
CO 4	M	H	H	L	M	L	M	M	L
CO 5	M	H	H		M	H	M	H	H

Semester I
25MCEC02

Human Infertility

Hours of instruction /week: 5
No. of credits: 5

Course Objectives: To enable students to

1. Understand the biology of in vivo fertilization and implantation
2. Learn the basics of the causes and diagnosis of male and female infertility
3. Acquire knowledge about the prognosis of diagnostic procedures

Unit 1: In Vivo embryo development

15 hours

Sperm and oocyte structure - Stages and genetics of fertilization – Gamete interaction– Embryogenesis – chromosomal segregation error in embryos

Unit 2: Implantation

15 hours

Timeline of implantation – Blastocyst hatching – Embryo endometrial interaction – Implantation immunology

Unit 3: Infertility

15 hours

Female infertility: causes, diagnosis and management – Male infertility: causes, diagnosis and management – Unexplained infertility

Unit 4: Male examination

15 hours

Physical examination of the male – Basic examination of the semen sample – WHO norms – Surgical sperm retrieval techniques

Unit 5: Female examination

15 hours

Physical examination of the female – Ultrasound examination – Infections – Reconstructive surgeries

Total hours: 75

Reference Books:

1. Human Embryology by Inderbir Singh (2018), 4th edition
2. Textbook of Assisted Reproductive Techniques by David Gardner, Volume 2 (clinical perspectives), 5th edition (2018)
3. Kamini.A.Rao (2023), 3rd edition, Principles and Practices of ART – Volume 1

Course Outcomes:

1. Obtain knowledge about the sequence of events in vivo.
2. Understand the causes of infertility, both male and female.
3. Thorough understanding of the physical examination of male and diagnosis.
4. Acquire knowledge about the female examination and diagnosis.
5. Understand the basics of immunological infertility.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	H	L				L	M	M
CO 2		M	H	L				L	
CO 3		M	H	H	M	M	H	L	H
CO 4		M	H	H	M	M	H	L	H
CO 5	L	L	M						H

Examination and Processing of Human Semen

Semester I
25MCEC03

Hours of instruction/week: 5
No. of credits: 5

Course Outcomes:

1. Understand the structure of sperm
2. To teach the sperm defects leading to infertility
3. Acquire knowledge about the prognosis of diagnostic procedures and quality control

Unit 1: Extended Examination of the Human Sperm

15 hours

Sperm defects – Interpretation of sperm examination results - Sperm DNA fragmentation causes and tests - Immature germ cells – Biochemical assays for accessory sex gland function – Assessment of sequence of ejaculation – Template of semen analysis form

Unit 2: Advanced Examination of the Human Sperm

15 hours

Seminal oxidative stress and reactive oxygen species testing – Assessment of the acrosome reaction and sperm chromatin – Transmembrane ion influx and transport of sperm – Effect of environmental factors on sperm parameters - CASA – Emerging technologies

Unit 3: Sperm Processing of Ejaculate Samples

15 hours

General principles – Simple washing – Direct Swim-up – Discontinuous density gradient – Magnetic cell sorting techniques – HIV infected sperm samples – Testicular and epididymal spermatozoa – Retrograde ejaculation samples – Assisted ejaculation samples

Unit 4: Quality Control and Quality Assurance

15 hours

Nature of errors in ejaculate examination –QA programmes–Statistical procedures for analysing and reporting between technician variability –external quality control –National external quality control programs for semen analysis

Unit 5: Accreditation for IUI Laboratories

15 hours

Indian laws for level 1 clinics – Personnel and equipment requirements – Consent forms for IUI procedures – Ethical requirement for IUI procedures

Total hours:75

Reference Book:

1. WHO laboratory manual for the examination and processing of human semen, 6th edition, 2021.

Course Outcomes:

1. Obtain knowledge about thorough examination of the sperm.
2. Understand about the advanced examinations required for sperm.
3. Theoretical knowledge about the various sperm processing techniques.
4. Acquire knowledge about the quality control in the procedures.
5. Knowledge on the latest Indian regulations for an IUI center.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO1	M	L	H	M	L	L	H	M	H
CO2	M	L	H	M	L	L	H	M	H
CO3	M		H	M	M	M	H	L	H
CO4		M	H	H	M	L	H	L	H
CO5			M	H	M	M	H	M	M

Andrology Laboratory and IUI (Intrauterine Insemination)

Semester I
25MCEC04

Hours of instruction/week: 5
No. of credits: 5

Course Objectives: To enable students to

1. Acquire knowledge on the setting up of an andrology laboratory
2. To understand about the equipments, consumables and disposables required
3. Understand the clinical aspects of an IUI procedure, cryopreservation and fertility preservation

Unit 1: Andrology Laboratory

15 hours

Ideal laboratory design with various rooms – Air filtering systems - Workstations – Equipment, supplies and reagents – Safety guidelines for an IUI laboratory

Unit 2: Clinical Aspects of IUI Procedure

15 hours

Indications for IUI – Pre procedure work up – Ovulation induction protocols – Ultrasound monitoring– IUI technique –Insemination catheters -Luteal phase support–IUI complications– Statistics and trouble shooting

Unit 3: Cryopreservation of Sperm

15 hours

Technical considerations for sperm freezing – Sperm freezing and thawing protocols – Vitrification methods–cryobiology of sperm–Autologous and donor sperm banking for infertility –Sperm banking for other indications–Funding challenges for sperm freezing– ethical challenges in sperm freezing – future avenues for sperm preservation

Unit 4: Onco fertility in Male

15 hours

Fertility preservation in adult male cancer patients – Managing fertility in childhood cancer patients – Fertility risk in paediatric and adolescent cancers – cryopreservation techniques and limitations

Unit 5: Transgender Males

15 hours

Factors that affect reproduction – Fertility preservation options – International transgender parenting rights – Limitations of Indian laws

Total hours: 75

Reference Book

1. Chaitanya Nagori, Practical guide to Intrauterine Insemination.
2. Narendra Malhotra, Manual on IUI: What, when and why.
3. Teresa.K.Woodruff, Textbook of oncofertility research and practice: a multidisciplinary approach.

Course Outcomes:

1. Obtain thorough knowledge about the setting of an IUI laboratory.
2. Understand the clinical female perspectives for an insemination procedure.
3. Theoretical knowledge about the cryobiology and cryopreservation of sperm.
4. Acquire the know-how of fertility preservation in onco patients.
5. Understanding the current need for transgenders in the reproductive medicine field.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO1			H	H	H	H	H	L	H
CO2	M	M	H	H	H	L	H	M	H
CO3			H	H	M	M	H	L	H
CO4	M	H	H		L		L	H	L
CO 5	M	M						M	H

Semen Analysis - Practical I

Semester I
25MCEC05

Hours of instruction/week: 4
No. of credits: 2

Course Objectives:

1. To learn about the examination of the semen sample and differentiate between the normal and abnormal parameters
 2. To learn motility grading
 3. To learn the morphology grading and identify the sperm defects
 4. To learn to generate a sperm analysis report based on the findings
- Examination of the semen sample –appearance, liquefaction time, volume, Ph
 - Abnormality in the semen parameters
 - Sperm concentration using the Makler chamber Sperm concentration using the slide.
 - Sperm concentration using the Neubauer chamber
 - Sperm viability assessment using the eosin and nigrosin staining method
 - Sperm morphology assessment using the eosin-nigrosin staining method Normal sperm
 - Acrosome defect Head defect Neck defect
 - Tail defect ERC
 - Fructose test Leukocyte test

Total hours: 60

Reference Books:

1. WHO laboratory manual for the examination and processing of human semen, 2021, 6th edition
2. David Mortimer, Practical laboratory andrology

Course Outcomes:

1. Thorough understanding about the semen parameters and the abnormalities.
2. Acquire knowledge about the calculation of sperm concentration using various methods.
3. Understanding about the staining methods and its principles.
4. Learn about the assessment of the live and dead sperm based on the staining methods.
5. Learn to assess the normal and abnormal sperm.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	M	M	H	L	L	H	M		M
CO 2	L	M	H	L	H		M		L
CO 3	L	L	H	L		H	M		L
CO 4	L	L	H	L		H	M		L
CO 5	L	L	H	L	L	H	H		L

Sperm Processing Techniques - Practical II

Semester I
25MCEC06

Hours of instruction/week: 4

No. of credits: 2

Course objectives:

1. To learn various methods of sperm processing methods
2. To learn to choose the specific processing method based on the sperm analysis
3. To dilute the sperm samples for IUI, IVF and ICSI procedures
4. To calculate the sperm DNA fragmentation index using a kit

- Simple centrifugation method Swim-up method
- Density gradient centrifugation method
- Dilution of sperm sample for IUI, IVF and ICSI procedures
- Sperm DNA fragmentation testing using the kit

Total hours: 60

Reference Books:

1. WHO laboratory manual for the examination and processing of human semen, 2021, 6th edition
2. David Mortimer, Practical laboratory andrology

Course Outcomes:

1. Assessment of the kind of processing method to be used based on the sperm parameters.
2. Understanding of the use of a combination of one or two techniques to maximize sperm concentration.
3. Learn the different dilution methods for the various procedures used in the IVF laboratory.
4. Understanding of handling the Sperm DNA fragmentation kit.
5. Understanding the SDF index and be able to give an interpretation.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L	L	H	M	L	L	H	L	L
CO 2	L	L	H	M	L	L	H	L	L
CO 3	L	L	H	M	M		M		H
CO 4	L	L	H	M			M		H
CO 5	M			M		L		M	

Laboratory Insights

Semester II
25MCEC07

Hours of instruction/week: 5
No. of credits: 5

Course Objectives: To enable students to

1. Acquire knowledge on the morphological and handling aspects of the oocyte
2. Understand the nuances of setting up of an ART laboratory
3. To understand about the equipments and maintenance of IVF unit

Unit 1: Handling of Oocytes

15 hours

Pioneers of IVF–History of the first IVF procedure–Early IVF lab–Emergence of IVF industry – International regulations for IVF practices – Processes and procedures

Unit 2: Establishment of an ART Clinic

15 hours

Location–Design–Facilities– Construction , renovation and building materials –Designing and operation of andrology, cryopreservation and PGD facilities – ‘Burning In’ of finished facility - Staff requirements

Unit 3: IVF Culture Systems: An Overview

15 hours

Incubators and working – Workstations and working – Microscopes and basic microscopy – Micromanipulators and working – Other equipment’s – Consumables, gases and culture media – New age equipment’s and their functioning

Unit 4: Air Quality Control in Reproductive Laboratories

15 hours

Design and implementation of air quality control – Air handling unit – Control of particles – Control of volatile organic products -VOC testing – pH testing – Co2 analyser – Cleaning and maintenance of a functioning IVF unit

Unit 5: Quality Control Procedures

15 hours

Sperm survival test–Culture of surplus oocytes / embryos / multi pronucleate embryo culture–Risk assessment and SOP’s–House keeping procedures in the IVF laboratory– Microbiological testing and contamination in the laboratory

Total hours: 75

Reference Books:

1. Alex Varghese, A practical guide for setting up an IVF lab, Assessment of embryo culture systems and running the unit
2. Gautam N and Allahbadia, Textbook of Assisted Reproduction
3. In-vitro fertilization, 4th edition, Kay Elder and Brian Dale

Course Outcomes:

1. Obtain thorough knowledge about the historical perspectives of early IVF.
2. Understand the intricacies involved in the setting of an IVF unit.
3. Theoretical knowledge about the various equipments and their functioning.
4. Acquire the know-how of air quality control in a productive laboratory.
5. Understand the know-how of the quality control procedures that is used in the laboratory.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO1	M	M	M	H	L	L	M	M	H
CO2	M		H	H	M	H	M		H
CO3	M	H	H	H	M	L		M	L
CO4			M	M	H	M	H		H
CO5			H	H	M	M	H		H

Embryo Culture Systems

Semester II

25MCEC08

Hours of instruction/week: 6

No. of credits: 6

Course Objectives: To enable students to

Understand the background of gamete and embryo culture

1. Acquire knowledge about the media culture
2. Obtain the know-how of the various aspects of the culture systems

Unit 1: Historical Background of Gamete and Embryo Culture

20 hours

Development of culture media based on oviduct and uterine fluids composition and simplex optimization—Physiology of embryo culture based on temperature, pH regulation, cellular volume and density regulation, effects of environmental pollution / Infection—Development of embryology using animal models

Unit 2: Media Composition

20 hours

Salts and osmolality – Energy sources and metabolism – Amino acids and cellular homeostasis – Macromolecules and embryo growth

Unit 3: Growth Factors in Media

15 hours

Antioxidants / chelators and cellular function – pH and buffers – Growth factors

Unit 4: Culture Systems

15 hours

Single step – Sequential – Embryo co – culture – Low oxygen culture – Embryo density – Air quality – Mineral oil overlay – Physiological and environmental factors that can affect the outcome of human ART – Micro fluidics

Unit 5: Culture Medium

20 hours

Media comparisons – Mono zygotic twinning due to culture systems – Epigenetic effects of embryo culture, culture media, serum, oxygen tension, multiple ART's

Total hours: 90

Reference Books:

1. Gary D. Smith, Embryo culture
2. Patrick Quinn, Culture media, Solutions and Systems in Human ART

Course Outcomes:

1. Understand the basics and historical aspects of embryo culture.
2. Acquire the knowledge about the various factors involved in media composition.
3. Acquire knowledge about the various growth factors required for embryo culture.
4. Theoretical knowledge about the different kinds of culture systems involved.
5. Understand about the external factor effects that are caused by extended embryo culture.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO1	H	H	H	L	L	L	H	M	M
CO2	M			M			H	M	H
CO3	M	L	M	L		L	H		H
CO4	H	H	H	L	M	H	H	M	M
CO5	H	H	H	L	M	H	H	M	M

Clinical Applications for Invitro Procedures

Semester II
25MCEC09

Hours of instruction/week: 5
No. of credits: 5

Course Objectives: To enable students to

1. Understand the indications for IVF treatment and the initial investigations
2. Acquire knowledge about the use of stimulation protocols
3. Obtain the know-how of the classification of oocyte and sperm selection

Unit 1: Patient Investigation and the Use of Drugs

15 hours

Diagnosis for IVF indication – IVF outcomes for the various causes–Diagnosis to prognosis and the prognostic factors–Prediction models for individualizing the treatment protocols– Overview of the male and female investigations

Unit 2: Stimulation Protocols for IVF

15 hours

Basics of follicular development – Monitoring ovarian stimulation – Roles of LH and HCG in protocols - Use of recombinants - Agonists and antagonists in COH – Ovarian stimulation for PCOS and poor responders – Luteal phase support

Unit 3: Oocyte Aspiration

15 hours

Stereo zoom microscope and its basics - Monitoring follicular development – Trigger and oocyte aspiration clinical aspect–Identification of oocyte and culture –Assessment of cumulus complex – Biology of stripping of cumulus complex

Unit4: Oocyte Classification

15 hours

Inverted microscopy and basics-Morphological characteristics of the oocyte (cytoplasm, vacuole, SER, refractile body, perivitelline space, zona pellucida, polar body) – Identification of nuclear maturity – Abnormal oocytes

Unit5: Non-invasive Sperm Selection

15 hours

Novel sperm tests –Sperm selection based on surface electrical charge –Micro fluidics for sperm selection – Sperm binding to the zona pellucida, hyaluronic acid binding assay and PICS1 – Non apoptotic sperm selection – MSOME – IMSI

Total hours: 75

Reference Books:

1. Gautam Nand Allahbadia, 2015,Ovarian stimulation protocols
2. Pasquale Patrizio, A color atlas for Human Assisted Reproduction
3. Ashok Agarwal, Non- invasive sperm selection for invitro fertilization

Course outcomes:

1. Understand the investigation process and prognosis.
2. Acquire knowledge about the various stimulation protocols.
3. Theoretical knowledge about the classification of oocytes.
4. Understand about the handling of oocytes in the laboratory.
5. Thorough knowledge about the sperm selection tests.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO1			H				M	L	
CO2	M	H			L	M	H	L	H
CO3	L	M	M	H	M	M	H	M	M
CO4			H	H	M	M	M	M	H
CO5	E		H	L	L		H		M

Cryopreservation of Sperm - Practical III

Semester II
25MCEC10

Hours of instruction/week: 4
No. of credits: 2

Course Objectives:

1. To learn about the vitrification cryopreservation methods
2. To learn the freezing methods for ejaculate, testicular sperm samples
 - Sperm cryopreservation methods for ejaculate samples
 - Sperm freezing methods for ejaculate samples
 - Sperm thawing methods for ejaculate samples
 - Sperm cryopreservation methods for testicular samples
 - Sperm freezing methods for testicular samples
 - Sperm thawing methods for testicular samples
 - Recovery rate for the freezing-thawing methods

Total hours: 60 hours

Reference Books:

1. WHO laboratory manual for examination and processing of human semen, 6th edition, 2022
2. In vitro fertilization, 4th edition, Kay Elder and Brian Dale

Course Outcomes:

1. Understanding of the appropriate processing method for sperm cryopreservation based on the sperm parameters.
2. Acquire knowledge about the appropriate sperm processing method for ejaculate samples.
3. Learn the appropriate method for thawing with maximum sperm survival.
4. Acquire knowledge about the appropriate sperm processing method for testicular tissue sample.
5. Learn the appropriate method for thawing testicular sperm samples with maximum sperm survival.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	M	M	H	L	M	M	M	H	M
CO 2	L	M	H	L	H	L	M	H	L
CO 3	L	L	H	L	H	L	M	H	L
CO 4	L	L	H	L	M	M	M	M	L
CO 5	L	L	H	L		M	H	M	L

Media Aliquoting -Practical IV

Semester-II
25MCEC11

Hours of Instruction / Week :4
No.of Credits : 2

Course Objectives:

1. To learn about media aliquoting for the various procedures
 2. To learn about the cold storage maintenance of media
 3. To learn about the temperature and pH maintenance of media prior to procedures
- Media aliquoting for oocyte aspiration
 - Media aliquoting for oocyte screening
 - Media aliquoting for sperm processing
 - Media aliquoting for hyasing
 - Media aliquoting for ICSI
 - Media aliquoting for IVF
 - Media aliquoting for IVF fertilization check
 - Media aliquoting for embryo culture
 - Media aliquoting for embryo transfer

Total hours: 60

Course Outcomes:

1. Learn about the various media required for the necessary procedure.
2. Understand the calibration required for media prior to the procedures.
3. Acquire knowledge about the various consumables used for media aliquoting.
4. Acquire knowledge about the good laboratory practices to follow while aliquoting media.
5. Obtain the know- how of aliquoting media for the processes.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	H	M	M	L	H	L	H
CO 2			H	L	L	L	H		H
CO 3			H	M	L		H	L	H
CO 4	L	L	M	M	H	H	M		H
CO 5			M	L		L	H		H

Micromanipulation, Fertilization, Zygote and Embryo Assessment

**Semester III
25MCEC12**

**Hours of Instruction / Week : 6
No. of Credits : 6**

Course Objectives: To enable students to

1. Understand the theory behind the micromanipulation techniques
2. Acquire knowledge fertilization process
3. Obtain the know-how of the pronuclei pattern and embryo grading

Unit 1: Oocyte Denudation and Preparation for ICSI

20 hours

Preparation and evaluation of oocytes for ICSI – Handling of oocytes – Oocyte denudation and preparation of oocytes for ICSI – IVM of immature oocytes

Unit 2: ICSI and IVF

20 hours

Setting up of microscope for the ICSI procedure – selection of oocytes for the ICSI procedure – selection of oocytes for the IVF procedure – Intra cytoplasmic sperm injection and polar body alignment – spindle view imaging for ICSI procedure - cytoskeletal events during in vitro fertilization -Assisted hatching

Unit 3: Fertilization Check

15 hours

Fertilization check for IVF/ICSI oocytes–Polar body extrusion – Pronuclei alignment and grading – Culture of zygotes

Unit 4: Embryo Culture and Grading

20 hours

Day 2 check and grading of embryos – Single step and sequential media – Day 3 check and embryo grading – Day 4 check and embryo grading – Day 5 check and embryo grading– David Gardner's blasto cyst grading method – Emerging technologies for embryo assessment

Unit 5: Advanced Embryology Techniques

15 hours

Transport IVF and transport ICSI – IVM – IVG – Epigenetics and epigenetic markers – Genomic imprinting – Epigenetic events during fertilization and preimplantation development – Epigenetic modification and ART – Epigenetic signatures of infertility – Future of epigenetics

Total hours: 90

Reference Books:

1. Hand book of invitro fertilization, 2017, David Gardner and Carlos Simon
2. Textbook of Assisted Reproductive Techniques (2volumes) by David Gardner, Ariel Weissman, Colin Howles, Zeev Shoham
3. Invitrofertilization, 4th edition, Kay Elder and Brian Dal

Course Outcomes:

1. Understand the preparation and evaluation process of sperm for fertilization.
2. Acquire knowledge about the ICSI and IVF insemination procedures.
3. Learn about the biology of iv vitro fertilization and zygote formation.
4. Thorough understanding of the embryo culture and embryo grading.
5. Acquire an insight into the future of ART

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L	M	H	H	M		H	L	H
CO 2	L	M	H		L	L	H	L	H
CO 3	L	M	H	M		H	H	L	H
CO 4	L	L	M		L	L	H	L	H
CO 5			M	H	H	H	H		

Choosing the Right Embryo and Chromosomal Abnormalities (Self Study)

Semester III
25MCEC13

Hours of Instruction / Week :2
No. of Credits :2

Course Objectives: To enable students to

1. Understand the embryo loading and transfer techniques
2. Acquire knowledge about the in vitro implantation process
3. Obtain the know-how of the choosing the right embryo or maximizing IVF success rate
4. Understand the diagnosis of diseases in pre implantation embryos

Unit 1: Handling of the Embryo and Embryo Transfer

5 hours

Choosing the right embryo for transfer and cryopreservation – Embryo catheter loading– Embryo transfer technique – Segregating embryo for cryopreservation and freezing methodologies – Maintenance of embryo in liquid nitrogen – Thawing of embryos

Unit 2: Fertility Preservation in Females

5 hours

Oocyte vitrification for cancer affected girls, adolescent girls and adult women – ovarian tissue cryopreservation and transplantation – Fertility preservation for social and other indications

Unit 3: Cryopreservation of Gametes and Embryos

10 hours

Principles of cryobiology – Cryopreservation protocols – Potential contamination during cooling and storage of cryopreserved samples – Embryo cryopreservation policies–Embryo selection for freezing – Ice Nucleation – Blastocyst cryopreservation – Clinical aspects of frozen embryo transfer – Ovarian tissue cryopreservation – Semen cryopreservation – TESE and TESA sperm cryopreservation

Unit 4: Implantation and Genetic Disease

5 hours

Embryonic regulation in the implantation process – use of biomarkers for the assessment of endometrial receptivity – chromosomal abnormalities in human embryos – genetic analysis of the embryo – polar body biopsy – blastomere biopsy – blastocyst biopsy

Unit 5: Essentials of ART Unit

5 hours

Data management and interpretation – Evidence based medicine – KPI's and statistics – Example template forms for reports and lab charts – Consent forms for various procedures – National guidelines for ART clinics, banks and surrogacy clinics

Total hours: 30

Reference Books:

1. Textbook of Assisted Reproductive Techniques (2volumes) by David Gardner, Ariel Weissman, Colin Howles, Zeev Shoham
2. Organization and management of IVF clinics, Alex 26 arghese

Course Outcomes

1. Understand about the handling techniques and transfer techniques of embryo.
2. Acquire knowledge about indications for fertility preservation.
3. Thorough understanding of the cryobiology of gametes and embryos.
4. Learn about the implantation process and genetic diagnosis diseases.
5. Understand about the other essential requisites for the successful running of an IVF unit.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L		M	L		L	H	L	M
CO 2	M	L	M				H	M	H
CO 3	M	H	H	M			H		H
CO4	L	H	M				H	L	M
CO5			L	H	H	H	H		H

Oocyte Handling – Practical V

Semester III
25MCEC14

Hours of Instruction / Week: 4
No. of Credits: 2

Course Objectives: To enable students to

1. Understand the technicalities and equipment's required for oocyte handling
 2. Acquire knowledge about maintenance of optimal temperature during the procedure
 3. Obtain the know-how of good laboratory practices
- Oocyte retrieval and identification of oocytes in the follicular fluid
 - Oocyte washing and assessment of cumulus complex
 - Oocyte culture –Group culture and single droplet culture
 - Stripping of oocytes to remove cumulus complex
 - Grading of oocytes
 - Selection of oocyte for ICSI

Total hours: 60

Reference Books:

1. Textbook of Assisted Reproductive Techniques (2volumes) by David Gardner, Ariel Weissman, Colin Howles, Zeev Shoham
2. Invitro fertilization, Kay Elder and Brian Dale
3. A color atlas for human assisted reproduction, Pasquale Patrizio, Michael JTucker, Vanessa Guelman

Course Outcomes:

1. Understanding of the equipment's used for the oocyte aspiration and hyasing process.
2. Learn to identify the oocytes from the follicular fluid.
3. Learn to grade the oocytes based on the cumulus:
4. Acquire the practical skills required for this particular procedure.
5. Acquire practical skills for the hyasing of oocytes while with minimal outside exposure.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L		L	H	H	H	H	L	H
CO 2	L	M	H				H	M	H
CO 3	M		H	L			H		H
CO4	L		H	M	M	M	H	H	H
CO5	M		H	M	M	M	H	H	H

Intra Cytoplasmic Sperm Injection (ICSI) and Invitro Fertilization (IVF) Insemination - Practical VI

Semester—III
25MCEC15

Hours of Instruction / Week :4
No.of Credits :2

Course Objectives: To enable students to

1. Understand the microscope basics and setting up of microscope for ICSI procedure
2. Acquire knowledge about insemination procedures
 - Setting up of microscope for ICSI procedure
 - Setting of the injection needle
 - Setting of the holding needle
 - Alignment of the needles in the same plane
 - Choosing the right sperm for ICSI
 - Immobilization of sperm
 - Holding the sperm in the Needle
 - Alignment of oocytes with polar body position for ICSI procedure
 - Alignment of holding needle, oocytes and injection pipette with sperm in the same plane
 - Intra cytoplasmic Sperm Injection without oocyte damage

Total hours: 60

Reference Books:

1. Textbook of Assisted Reproductive Techniques(2volumes) by DavidGardner,Ariel Weissman, Colin Howles, Zeev Shoham
2. Invitro fertilization,KayElder and BrianDale
3. A color atlas for human assisted reproduction ,Pasquale Patrizio ,Michael JTucker,Vanessa Guelman

Course Outcomes:

1. Acquire knowledge about the handling of microscopes
2. Setting up of the microscope required for the process.
3. Obtain practical skills for the immobilization of sperm prior to injection.
4. Acquire knowledge about the alignment of oocytes correctly prior to injection.
5. Obtain practical skills on injecting the sperm in to the oocyte without damaging the oo

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1.	M		L	H	H	H	H	M	H
CO 2				H		H	H		H
CO 3	M		L	M	M	M	H		H
CO 4	M	M	H				H	M	H
CO 5	M		H	M	M	M	H	L	H

Zygote / Embryo Grading and Culture – Practical VII

Semester–III
25MCEC16

Hours of Instruction /Week: 4
No. of Credits:2

Course Objectives : To enable students to

1. Understand the practicalities of fertilization check for IVF/ICSI oocytes
2. Acquire knowledge about embryo culture and grading
3. Obtain the know-how of optimal maintenance of laboratory and incubators

- Fertilization check – 0pn ,2pn ,3pn
- Pronuclei grading- alignment and number of pronucleus
- Embryo culture
- Day 2 grading
- Day 3 grading
- Day 4 grading

Total hours: 60

Reference Books:

1. Textbook of Assisted Reproductive Techniques (2volumes) by David Gardner, Ariel Weissman, Colin Howles, Zeev Shoham
2. Invitro fertilization, Kay Elderand Brian Dale
3. A color atlas for human assisted reproduction, Pasquale Patrizio, Michael JTucker, Vanessa Guelman

Course Outcomes:

1. Obtain practical knowledge about identifying the fertilization process of the zygotes.
2. Understand about the quality of the embryo based on pronuclei grading.
3. Acquire knowledge about the embryo grading.
4. Obtain practical knowledge about the segregation of embryos.
5. Choose the best embryo for transfer or cryopreservation.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	L		H	L		L	H	M	H
CO 2	H	M	M		L		H		H
CO 3	H	M	H		L		H		H
CO 4	M		H	L	L	L	H	L	H
CO 5	M		H	L	L	L	H		H

Embryo and Oocyte Cryopreservation – Practical VIII

Semester-III
25MCEC17

Hours of Instruction/Week:4
No. of Credits:2

Course Objectives: To enable students to

1. Understand the practicalities of embryo freezing and thawing
2. Have hands on training on the thawing protocol of oocytes and embryos
3. Obtain the know-how of optimal maintenance of laboratory and incubators
 - Choosing oocytes for cryopreservation
 - Oocyte freezing
 - Oocyte thawing
 - Choosing embryos for cryopreservation
 - Embryo freezing
 - Embryo thawing

Total hours: 60

Reference Books:

1. Textbook of Assisted Reproductive Techniques (2volumes) by David Gardner, Ariel Weissman, Colin Howles, Zeev Shoham
2. In vitro fertilization, Kay Elder and Brian Dale
3. A color atlas for human assisted reproduction, Pasquale Patrizio, Michael JTucker, Vanessa Guelman

Course Outcomes:

1. Thorough knowledge about the choosing the right oocytes for cryopreservation.
2. Acquire practical skills about the oocyte vitrification technique.
3. Obtain thorough knowledge about choosing the right embryos for cryopreservation.
4. Acquire practical skills about the embryo vitrification technique.
5. Learn hands-on skill for the thawing of oocytes and embryos.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	M	M	M				H	M	H
CO 2	M		M	L	L	L	H		H
CO 3	M	M	M				H	M	H
CO 4	M		M	L	L	L	H		H
CO5	M		H	L	L	L	H	L	H

Mini Project

Semester–III
25MCEC18

Hours of Instruction / Week: 2
No. of Credits : 2

Course Objectives : To enable students to

1. Apply Research Methodology to practice.
2. Emphasize on action research.
3. Spread scientific knowledge through presentations and publication

Course Outcomes:

1. Apply the concepts of research and its methodologies identify appropriate research topics.
2. Practice select and define appropriate research problem and parameters.
3. Compose a project proposal.
4. Organize and conduct research.
5. Write a project report with good APA style for scholarly writing.

Internship

Semester– III
25MCEC19

Hours of Instruction / Week: -
No. of Credits : 2

Course Objectives: To enable students to

1. Integrate knowledge and training in dealing with people
2. Examine the knowledge and executing it in reality
3. Develop trained manpower with strong knowledge base in clinics

Course Outcomes:

1. Effectively manage the health and safety aspects of a biological laboratory.
2. Acquire knowledge and skills in educational technology.
3. Write an internship report.

Current Advances in Assisted Reproductive Technology

Semester-III
25MCEPD1

Hours of Instruction/Week:3
No. of Credits:Remarks

Course Objectives : To enable students to

1. Understand the Role of AI in Embryo Selection and IVF:
2. Examine Innovations in Fertility Preservation:
3. Explore Advanced Fertility Treatments and Genetic Therapies

Unit 1: Artificial Intelligence in Embryo Selection and IVF

09 Hours

Overview of AI applications in IVF-Time-lapse imaging and embryo viability prediction-Machine learning algorithms for embryo grading-AI vs embryologist: Accuracy and reliability-Clinical outcomes and success rate improvements

Unit 2: Vitrification Devices and Their Impact on Embryos

09 Hours

Principles of vitrification vs. slow freezing-Modern vitrification devices (e.g., Cryotop, CryoTip)-Effects of vitrification on embryo survival and implantation-Optimization of cryoprotectants and protocols-Long-term developmental outcomes

Unit 3: Bioprosthetic Ovaries and Fertility Restoration

09 Hours

Concept and development of bioprosthetic ovaries-Animal model studies and potential in humans-Applications in cancer survivors and premature ovarian failure-Ethical and practical considerations

Unit 4: Advanced Micromanipulation Techniques: Micro-TESE and ICSI

09 Hours

Micro-TESE (Microsurgical Testicular Sperm Extraction): Indications, procedure, and outcomes, Intracytoplasmic Sperm Injection (ICSI): Techniques and indications-Combined use in cases of severe male infertility-Sperm retrieval success rates and fertilization outcomes-Risks and ethical aspects

Unit 5: Mitochondrial Replacement Therapy (MRT) in Oocytes

09 Hours

Role of mitochondria in oocyte health and embryonic development-Types of MRT: Spindle transfer, pronuclear transfer-Prevention of mitochondrial diseases-Legal and ethical debates around "three-parent babies"-Current research, clinical trials, and global regulation

Total hours: 45

Reference Books:

1. "Clinical Gynecologic Endocrinology and Infertility"

Authors: Marc A. Fritz, Leon Speroff

2. "Assisted Reproductive Technology: A Clinician's Guide to Assisted Reproductive Technology"

Editors: Botros Rizk et al.

Course Outcomes:

1. Demonstrate an understanding of AI applications in embryo selection and IVF protocols
2. Critically analyze the effectiveness and safety of vitrification devices
3. Explain the development and future potential of bioprosthetic ovaries
4. Evaluate the principles, procedures, and ethical considerations of mitochondrial replacement therapy
5. Apply knowledge of Micro TESE and ICSI techniques

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	M	M	M				H	M	H
CO 2	M		M	L	L	L		L	
CO 3	M	M					H	M	H
CO 4	M		M	L	L	L	H		H
CO5	M		H	L	L	L	H	L	H

Laser Hatching and Embryo Biopsy - Practical IX

Semester– IV
25MCEC20

Hours of Instruction /Week: 4
No. of Credits :2

Course Objectives: To enable students to

- Observe the embryo biopsy techniques for genetic analysis
- Observation of blastomere biopsy for genetic analysis
- Observation of blastocyst biopsy for genetic analysis
- Observation of laser assisted hatching

Total hours: 60

Reference Books:

1. Atlas of Preimplantation Genetic diagnosis, 3rd edition, Anver Kuliev, Svetlana Rechitsky, Oleg Verlinsky

Course Outcomes:

1. Understand the technicalities behind laser assisted hatching.
2. Acquire practical knowledge about blastomere biopsy for genetic analysis.
3. Acquire practical knowledge about the blasto cyst biopsy for genetic analysis.
4. Learn to segregate and freeze the embryos.
5. Acquire knowledge about report assessment.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	M	L	M	M	M	M	H		H
CO 2	M		H				H	L	H
CO 3	M		H				H	L	H
CO 4	M	M	M		L	L	H	H	
CO5	L	L		L	M	M	M	L	M

Research Project

Semester – IV

Hours of Instruction / Week: 26 25MCEC21

No. of credit : 20

Course Objectives: To enable students to

1. Determine the purpose of the study with assumed outcomes
2. Overview of research and statistical models commonly used in medical and biomedical sciences.
3. To impart an intuitive understanding and working knowledge of research designs and statistical analysis.

Course Outcomes:

1. Describe the research process and the principle activities, skills and ethics associated with the research process.
2. Practice select and define appropriate research problem and parameters.
3. Organize and conduct research using various interventions.
4. Understating of background theory of various commonly used statistical techniques as well as analysis interpretation & reporting of results and use of statistical software.
5. Write a project report with good APA style for scholarly writing.

