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UNIVERSITY OF MYSORE

Estd.1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

(Re-accredited by NAAC at 'A')

(NIRF-2023 Ranked 44 in University Category & 71 in Overall Category)

No.: PMEB-1/Spl./10(1)/2023-24 **Date: 04-11-2024**

NOTIFICATION

Sub.: Modified Syllabus of **M.Sc. (Assisted Reproduction and Embryology)** course under Specialized Programmes from the academic year 2024-25-reg.

Ref.: 1. Decision of the BOS Meeting held on 06-08-2024.
2. Decision of the Academic Council meeting held on 22-10-2024.

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The Board of Studies in **M.Sc. (Assisted Reproduction and Embryology) (PG)** at its meeting held on 06-08-2024 has resolved and recommended modification in the Syllabus of **M.Sc. (Assisted Reproduction and Embryology)** course in University of Mysore under specialized/ specified programs from the academic year 2024-25.

The Academic Council has also approved the above said proposals at its meeting held on 22-10-2024 and the same is hereby notified.

The modified Syllabus of **M.Sc. (Assisted Reproduction and Embryology)** course may be downloaded from the University website **https://uni-mysore.ac.in/PMEB/.**

REGISTRAR

REGISTRAR
University of Mysore
MYSURU - 570 005

To,

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DoS in Mathematics, Manasagangothri, Mysuru.
3. Prof. K. Kemparaju, DoS in Biochemistry, Manasagangothri, Mysuru.
4. The Principal, International Institute for Assisted Reproductive Technology and Research Center, # 81-82, Near JSS Arts and Commerce College, Ooty Road, Mysuru.
5. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
7. Office Copy.

Minutes of Meeting

Proceedings of the Board of Studies Meeting for M.Sc. (Assisted Reproduction and Embryology) was held on Tuesday 6th August 2024 at Conference Room , IIARTRC center, Mysore.

Chairperson Dr. Kemparaj K welcomed the members and requested their cooperation for smooth conduct of the BoS meeting.

The proposed syllabus of I and II year (I to IV semester) MSc, Assisted Reproduction and Embryology course was discussed in detail and finalized the syllabus as per the university norms.

Finally chairperson thanked all the members for their cooperation for the successful completion of the BoS meeting.

Member present:

Sl. No.	Name		Signature
1	**Dr. Kemparaj K**	Chairperson	
2	**Dr. Prasanna K S**	Member	
3	**Dr. Shashi Kumar B M**	Member	
4	**Dr. Shilpa C V**	Member	
5	**Dr. Ravi Kumar H**	Member	

Members Absent:

Sl. No.	Name
1	**Dr. Srinivasa M S**
2	**Dr. Santhrupth H V**

Chairperson
BoS in Assisted Reproduction and Embryology

Annexure -1

3

International Institute for Assisted Reproductive Technology and Research Centre (IIARTRC)

Specialized Programme by University Of Mysore
CAGP Pattern (2022-2023)

M.Sc.(Assisted Reproduction and Embryology)

Regulation and Syllabus

Regulations

The credit pattern for Assisted Reproduction and Embryology is similar to the University's Credit system. However, the syllabus does not have soft core and open elective Papers. All subjects are mandatory. The total credit for course is same as that of PG programme of the University.

Following shall be the minimum and maximum credits per semester.

The credit pattern is lecture (L); Tutorial (T); Practical (P); (L: T: P) Pattern.

Lecture: One hour session of theory class per week in a semester is 1 credit.

Tutorial and practical: Two hour session of tutorial or practical per week in a semester is 1 credit.

One semester period: 16 weeks of teaching and learning.

Duration of semester: 20 weeks that includes semester end examinations.

- A Candidate can enroll for a minimum of 16 credits per semester and maximum of
- 20 credits per semester.

- A Candidate has to earn a minimum of 76 credits for successful completion of a Master Degree.

C1 - Multiple Choice test 10 marks, Assignment 5 Marks

C2 - Test descriptive 10 marks, Topic presentation 5 Marks

Continuous assessment pattern:

Continuous assessment	Time duration	Marks		Minimum 30% and an aggregate of 40% to declare pass
		Max	Min	
C1	1 week to 8 weeks	15	4.5	
C2	9 weeks to 16 weeks	15	4.5	
C3	Complete 16 weeks	70	21	

Eligibility for Admission: Students of Bachelor of Science Degree (B Sc) from any UGC Recognized Universities with life Science subjects or any equivalent bachelor degree / MBBS/BDS/BAMS/BHMS/B.Pharma/B.Sc Nursing/Engineering with sciences (Biotechnology and life science related) and Students from foreign nationals are also eligible subjected to eligibility from University of Mysore, Admission will be done as per University of Mysore norms.

SEMESTER I **(20)CREDITS**

Paper Code	TITLE OF THE PAPER	CREDIT PATTERN			TOTAL CREDITS
		L	T	P	
49401	**Cellular Biology , Biochemistry & Biophysical Techniques**	4	0	0	4
49402	**Human Reproductive Biology**	4	0	0	4
A 01	**Andrology Laboratory Techniques-1**	0	0	6	6
A 02	**Andrology Laboratory Techniques-2**	0	0	6	6
		8	**0**	**12**	**20**

SEMESTER II **(20) CREDITS**

SL NO	TITLE OF THE PAPER	CREDIT PATTERN			TOTAL CREDITS
		L	T	P	
49406	**Genetics & Reproductive Endocrinology**	2	0	0	2
49407	**Assisted Reproduction**	2	0	0	2
B 03	**In-Vitro Fertilization techniques**	0	0	8	8
B 04	**Clinical Embryology**	0	0	8	8
		4	**0**	**16**	**20**

SEMESTER III **(20)CREDITS**

SL NO	TITLE OF THE PAPER	CREDIT PATTERN			TOTAL CREDITS
		L	T	P	
49411	**Infertility Counseling**	2	0	0	2
49412	**Human Gametes and Embryo culture System**	2	0	0	2
C 03	**Micromanipulation in ART**	0	0	8	8
C 04	**Cryobiology and Techniques**	0	0	8	8
		4	**0**	**16**	**20**

SEMESTER IV **(16) CREDITS**

SL NO	TITLE OF THE PAPER	CREDIT PATTERN			TOTAL CREDITS
		L	T	P	
49416	**Preimplantation Genetic Screening (PGS)**	2	0	0	2
49417	**Quality control and risk management in ART**	2	0	0	2
D 03	**Writing and presentation skill**	0	2	0	2
D 04	**Project Work**	0	0	10	10
		4	2	**10**	**16**

PREAMBLE

Infertility is more common than most people think. Today, as many as one in seven couples trying to have a baby will experience infertility. In fact, recent studies show that after a year of having unprotected sex, 15 percent of couples are unable to conceive a child, This could be due to changes in various environmental factors and life style of the couples.

The role of embryologist came in to the picture after the birth of first IVF baby Louise brown in the year 1978. Since then embryology was practiced by postgraduates from life science subjects.

There is a huge surge in infertility rates among couples. India with a huge population, percentage of infertile couple is increasing day by day. In order to address this issue many assisted reproductive technology (ART) units have come up all over India.

To deal with ART there are two Departments playing important role, one is the clinician who has done medical post graduation or specialized course in infertility and another one is embryology, who has done a post graduation in life science course with a proper training in ART Unit.

Hence, knowledge of embryology is a must to deal with ART procedures effectively. There is a need for professionally trained embryologist with in the country and also abroad. It is known that embryologist is a back bone of ART unit . Master degree in ART curriculum designed in such a way those students after the completion of the course will be competent enough to take up a job as an embryologist in any ART unit. This programme also opens the venue for advanced research in the field of infertility. M Sc in ART is pursued under Choice Based Credit System.

PROGRAMME OUTCOME

M.Sc., ASSISTED REPRODUCTION AND EMBRYOLOGY

On successful completion of this programme each student will be able to

- Build a strong foundation in embryology by understanding the basics which is very much essential to emerge as a successful embryologist.
- He/she will be able to setup Andrology laboratory and deal with various diagnostic procedures independently.
- Gain the knowledge in various subjects like human reproductive biology, cell biology, biochemistry, physiology, microbiology genetics and various techniques of ART.
- Will be able to counsel the infertile couple effectively about various IVF procedures.
- Being a part of ART team, he/she can take a challenge of setting up of an IVF laboratory and make it a very successful IVF unit.
- Acquire technical skills, communication skills which is very important to become a successful embryologist.
- Equipped with thorough knowledge in the field of embryology, they can enter into the research field and carryout advanced research in reproductive medicine, which is going to be useful for infertile community.
- Students will be well equipped to pursue as a teacher in the field ART.

Semester 1 20 Credit

Paper 1.1 Cellular Biology, Biochemistry and Biophysical Techniques

(4 credits-4 Hours /Week)-64 Hours

On successful completion of this course each student will be able to

- Understand the basics of cell structure and composition of prokaryotic and eukaryotic cell.
- Understand the importance of genetics in the field of infertility.
- Understand about cancer biology, properties of cell types of cancers, programmed cell death and molecular mechanism of apoptosis.
- Understand how to handle various sophisticated equipment in the IVF unit.

Unit I. Cell Biology 32 Hours

Basic Characteristics of the Cell organelle: Diversity of cell size and shape, Cell theory, Structure, organization and composition of prokaryotic and eukaryotic cell. Plasma membrane chemical composition and structure of membrane and functions. Structure and functions of eukaryotic cell organelles.

Chromosomes- Types of Chromosomes and molecular anatomy of eukaryotic chromosomes, nucleosomes organization. Structure and significance of polytene and lamp brush chromosomes. Numerical changes in chromosomes.

Cell division: - Mitosis and meiosis. Significance of cell division. Cell cycle and cell cycle check points. Molecular regulation of cell cycle.

Cancer Biology: Properties of cell types of cancers, Cancer therapy, Programmed Cell death and Molecular mechanism of Apoptosis. Introduction to signal transduction.

Unit II. Biochemistry 16 Hours

Structures of atoms, molecules and bonds, chemical foundations of biology. Covalent and non-covalent interactions, Vander –Wall forces, electrostatic and Hydrogen bonding and hydrophobic interactions.

Classification, structure and Properties of carbohydrates, amino acids and proteins, and lipids. Nucleic acids - Structure and properties - Bases, Nucleosides, Nucleotides, Polynucleotide. Structure of double stranded DNA. Types of RNAs and their biological significance.

Spectroscopic techniques: Electromagnetic spectrum of light, Beer-Lambert's law, Principle and application of UV, Visible and UV spectrophotometer.

Unit III. Biophysical Techniques **16 Hours**

Introduction to Biophysics: Scope of Biophysics, Interaction of living and non-living matters, chemical foundations of Biophysics.

Microscopic Techniques: Principle and application of light, Phase contrast, Dark field, Fluorescence microscopy, Scanning and Transmission Electron Microscopy.

Centrifugation Technique: Principle, techniques of analytical and ultracentrifuges.

Electrophoresis and Blotting Techniques: Principle and application of PAGE, SDS-PAGE, and Agarose gel, Southern, Northern and Western blotting techniques. ELISA and TUNNEL Assay.

Paper 1.2 Human Reproductive Biology (4 credits - 4 hours/Week) –64 Hours

On successful completion of this course each students will be able to

- Understand the history of assisted reproductive technology and the place where first world test tube baby was born.
- Gain thorough knowledge about male and female reproductive system
- Understand detail composition of seminal plasma, which is a must before they start doing semen examination
- Successfully carry out semen examination following WHO manual

UNIT 1 **32 Hours**

- **History and Introduction of gamete biology** : Biomedical background of Bourn Hall Clinic. The Bourn Hall story. Gonadal changes from birth to puberty, Puberty and its timing, Environmental factors and puberty, Puberty and Psychological adjustment. Anatomy of male and female reproductive systems. Gamete biology: Spermatogenesis and oogenesis.
- **Andrology:** Detailed Composition of seminal plasma.
- **Semen Examination;** Introduction, sample collection methods, sample collection for diagnostic or research purposes. Sterile collection of semen for assisted reproduction and microbiological analysis. Sample collection at home, collection of semen by condom. Safe handling of specimens.
- **Initial examination:** Liquefaction, semen viscosity, semen appearance, semen volume and pH.
- **Initial microscopic examination:** Thorough mixing of the sample, making wet preparation, Cellular elements other than spermatozoa.
- **Sperm motility:** categories of sperm movements, preparation and assessment of sperm motility.

Sperm vitality test: Eosin-nigrosin, Eosin alone and Hypo-osmotic swelling test (HOS).

- **Sperm Concentration estimation:** Types of counting chambers. Sperm Morphology assessment: Preparation of sperm smear, assessment of sperm. Morphology, staining procedures for sperm morphology. Assessment of specific sperm defects. Assessment of sperm leukocytes in semen. Assessment of immature germ cells in semen.

Biomedical assay for accessory sex organ function: measurement of fructose and zinc in seminal plasma. Ultra structure of spermatozoa.

UNIT 2 **32 Hours**

- **Male and female reproductive system:** congenital or developmental disorders associated with primary testicular disorder, Klinefelter Syndrome, cryptorchism.
- Varicocele, infection, Drug and radiation Sperm transport disorders. Poor semen parameters. Causes of female infertility: Failure to ovulate, Problem in menstrual cycle, infection, failure to mature egg properly, endometriosis. Primary ovary insufficiency, uterine anomaly and fibroid.
- **Infertility trends worldwide, infertility in India.** Various Environmental factor effects on male and female infertility. Clinical examination of male and female.
- **Female infertility:** Disorders of female reproductive system, Fallopian tubal block, hydrosalpinx. Polycystic ovary syndrome (PCOS). Physiology of ovulation. Ovarian cycle, menstrual cycle. Ovulation and anovulation, ovarian stimulation protocol. Human early embryology development. Fertilization. Early Cleavage . Blastocyst. Implantation. Gastrualation and Placentation.

Practical paper-1.3 **(6credits-12hours/week) 16 weeks**

Paper title: Andrology Laboratory Techniques - 1

On successful completion of this course each students will be able to

- Understand the basics of andrology laboratory setup.
- Understand various equipments role in carrying out semen examination and semen processing and other procedures.
- Learn different stages of mitosis, meiosis and human karyotyping.

1. Handling of different types of Microscopes.
2. Study of different Mitotic stages.
3. Study of different meiotic stages.
4. Preparation of mitotic chromosomes using onion root tip.
5. Preparation of meiotic chromosomes using grass hoppers testis.
6. Study of Polytene chromosomes of Drosophila.
7. Construction of Human Karyotypes using metaphase plate (Normal Male and female).
8. Construction of Human abnormal Karyotypes using metaphase plate (Turner, Klinefelter`s and Down syndrome).
9. Gram staining technique using curd sample.
10. Measurements of microscopic materials using stage and ocular micrometry.

11. Setting up of an IUI Laboratory.
12. Equipment and safety: Basic supplies needed in and Andrology laboratory.
13. Potential biohazards in Andrology laboratory, safety procedure.
14. Safety Procedure of laboratory Equipment's, precautions when handling liquid nitrogen.
15. Brief Account of equipment's: laminar air flow, various types of microscope, stereo zoom microscope, inverted microscope, Incubator used for IUI/dry bath, Centrifuge unit, Refrigerator, Makler chamber, Neuber chamber, sperm concentration .
16. Sperm preparation: Introduction, Choice000000000000000000000000 of method, Efficiency of sperm separation from seminal plasma and infectious organism, simple washing procedure, Direct swim-up, Diffuse density gradient.
17. Preparation of HIV infected semen sample.

Practical paper- 1.4 **(6credits-12hours/week) 16 weeks**

Paper Title: Andrology Laboratory Techniques- II

On successful completion of this course each student will be able to

- Understand how to assure a quality control in andrology laboratory
- Learn cryopreservation of semen sample and can establish human semen bank
- Handle Computerized Assisted Semen Analysis (CASA) Independently to perform semen examination
- Perform various sperm functional tests
- Understand how to manage biological waste in IVF lab

1. 00000000000000000000Semen examination with Kruger's criteria.
2. Semen cryopreservation protocol: standard procedure modified freezing protocols for poor semen samples, labeling of straws and record.
3. Assessment of sperm chromatin: aniline blue test, alcidine orange test, sperm chromatin structure assay (SCSA), Comet assay and TUNEL assay.
4. Quality Control in the andrology laboratory.
5. Assessment of the acrosome reaction.
6. Assessment of nuclear decondensation of sperm and other functional test.
7. Measurement of reactive oxygen species generated by leukocytes and sperm suspension.
8. Sperm survival test.
9. Use of CASA to assess sperm motility.
10. Use of CASA to sperm morphology assessment.
11. Preparation of testicular and epididymal spermatozoa .
12. Preparation of retrograde ejaculation sample.
13. Antisperm antibody test .
14. Advanced types of sperm preparation for ART .
15. Mouse reproductive Anatomy .
16. Mouse reproductive physiology .
17. Biomedical waste Management .

Semester II 20 Credits

Paper 2.1: Genetics & Reproductive Endocrinology

(2credits-2hours/week) - 32 Hours

On successful completion of this course each students will be able to

- Understand about fundamentals of genetics Mendelian Laws .
- Learn about sex linked inheritance in Human being.
- Understand Human endocrinology.
- Know about hormonal regulation of spermatogenesis and oogenesis.

UNIT 1 **16 Hours**

Introduction to Genetics: Mendels Laws. Genotype, Phenotype, Mendelian inheritance pattern.Interaction of genes: Supplementary, complimentary, epistasis, polygenic and multiple alleles and lethal gene interactions with suitable examples.

Sex linked inheritance:Sex linked inheritance in man (Haemophilia and colour blindness). Y- linked genes.

Sex determination:- Chromosomal basis, Genic Balance theory, molecular sex determination in Drosophila, C. elegans and Humans.

Dosage compensation in human. Chromosomal variations, Chromosomal aberrations with examples.

Protein synthesis-Translation and transcription in prokaryotes, post transcriptional modificationin Eukaryotes.Gene regulation: Lac Operon, Tryptophane Operon and Arabinose Operon regulation. Gene Mutation and Human genetic disorders.

Human genome Project: Introduction and applications.

UNIT 2 **16 Hours**

Human endocrinology: Hormones and their function, hypothalamic pituitary function, thyroid hormones and their role. Principles of hormone assay, various equipment to do hormone assay, Immuno assay. Hirsutism primary and secondary amenorrhea.

Male and female Reproductive Endocrinology. Hormonal regulation of spermatogenesis and ovarian cycle. Physiology of implantation, luteal phase defect.

Hormonal Disorders causing infertility: PCOS hyperprolactinemia, Thyroid Disorders.

Paper 2.2: Assisted Reproduction (2 Credits - 2 hours/week) - 32 Hours

On successful completion of this course each students will be able to

- Understand the gonadotrophins role in folliculogenesis.
- Learn various procedures involved in IUI preparation and different types of sperm surgical retrieval techniques.
- Understand about various controlled ovarian stimulation.
- Acquire a technical skill of ovum pickup and embryo transfer.

UNIT 1 **16 Hours**

- History of assisted reproduction.
- Gonadotropins in ART; Follicle stimulation Hormone (FSH), Luteal hormone (LH) Estradiol and progesterone.
- Ovarian reserve test, by AMH / Antral follicle count.
- IUI preparation and procedure.
- Removal of hydrosalpinges to improve IVF outcome.
- Ovarian endometriomas and IVF outcome.
- Uterine cavity abnormality and IVF outcome
- Various kind of sperm retrieval technique for ART.
- Fertility drugs and ovarian cancer.
- Optimizing IVF outcome.

UNIT 2 **16 Hours**

- Controlled Ovarian Stimulation in IVF.
- Various stimulation Protocols-Agonist/ Antagonist.
- Natural Cycle IVF.
- Egg Retrieval –Transvaginal,Laparoscopic.
- Embryo Transfer- Fresh Embryo, Frozen Embryo.
- Ultrasound in ovarian stimulation and follicle monitoring.
- Endometrial Preparation in ART.
- Ovulation in PCOS.
- Ovarian hyper stimulation syndrome (OHSS).
- Luteal phase defects in ART Cycles.
- Luteal phase Support in IUI/IVF.
- Implantation Failure/ Endometrial Scratching to improve implantation.
- Oocyte markers of competence: Nuclear maturity, Cytoplasmic maturity, Polar bodies, Zona Pellucida, Cumulus cells.
- IVF outcome – Multiple Pregnancy, ectopic pregnancy, miscarriage, premature ovulation.

SEMESTER II

Paper 2.3: In-Vitro Fertilisation Techniques (IVF Techniques) Practical Paper-1
(8 Credits- 16 Hours/Week) 16 Weeks

On successful completion of this course each student will be able to

- Understand the history of infertile couples by going through various details of patient medical record.
- Learn human gamete culture system, culture medium preparation and quality testing of the medium.
- Understand the various techniques like oocyte screening, Insemination, dish preparation, assessment for fertilization and further development till embryo transfer.
- Know how to assess the pronuclear stage zygote and predict how the quality of embryo is going to be when it is cultured further in vitro.

1. Preparation for IVF procedure: Going through patient file to know about type of stimulation protocol, Gonadotrophins used.
2. Previous history of IVF, if patient underwent IVF elsewhere.
3. Culture Medium in ART: Media preparation for ART, detailed account of culture medium, sperm survival test, media preparation for intra uterine insemination (IUI) and IVF-ET.
4. Method of fertilization, number of good quality oocytes, fertilization and number of embryos, and quality of embryos available.
5. Preparation for the IVF procedure: Medium aliquoting into sterile tube, Dish preparation for IVF and ICSI.
6. IVF witnessing.
7. Dish preparation for IVF: close and open culture system.
8. Sperm concentration calculation for IVF.
9. Insemination of IVF droplet with sperm and co-incubation.
10. Follicular fluid screening.
11. Identification of oocytes, washing and pre-incubation.
12. Assessment of Oocyte quality, IVF and fertilization check.
13. Pronucleus grading .
14. Fragmentation and grading the embryo,
15. Extraction of the oocytes from the ovary(Slaughter house),

SEMESTER II

Paper 2.4 : Clinical Embryology **(8 Credits - 16 Hours/Week) 16 Weeks**

On successful completion of this course each student will be able to

- Understand the important points to be considered when setting up of an IVF laboratory.
- Learn in detail the quality control in IVF laboratory and trouble shooting.
- Understand various culture systems like open and close culture systems widely used in all IVF units.
- Know how to grade the human embryo at various developmental stages.

Practical Paper

1. Setting up of ART Unit with various facilities and a detailed Account on embryology laboratory and equipments.
2. Quality control, quality assurance and trouble shooting in IVF lab.
3. Equipments to control air quality in Embryology laboratory.
4. Sterilization methods.
5. Good laboratory practice (GLP).
6. Tissue culture techniques.
7. Preparation of standard operation protocol for all procedures in the IVF laboratory.
8. Culture system: Open and close culture advantages and disadvantages.
9. Preparation for follicular fluid aspiration, culture medium disposables.
10. Insemination of processed sample, Conventional IVF.
11. Short term insemination and long term insemination, fertilization check, observation of fertilized Oocytes till Blastocyst development.
12. Cleavage stage embryo grading.
13. Blastocyst grading.
14. Blastocyst culture advantages and disadvantages.

Semester III (20 Credits)

Paper 3.1: Infertility Counselling (2 Credits - 2 Hours/Week) - 32 Hours

On successful completion of this course each students will be able to

- Understand the basics of infertility counseling.
- Understand medical aspects of the infertility for the counselor.
- Undertake the psychological evaluation of infertile couple.
- Understand about genetic, sexual, counseling.
- Know about ethical aspects of infertility, legal issues, and embryo donation counseling.

UNIT 1 **16 Hours**

- Basics of counseling.
- Infertility counseling.
- Psychology of infertility.
- Medical aspects of the infertility for the counselor.
- Cross cultural issues in infertility counseling.
- Psychological evaluation of the infertility couple.
- Evidence based approach to infertility counseling.
- Individual counseling and psycho therapy.
- Counseling the infertile couple.

UNIT 2 **16 Hours**

- Group approach to infertility counseling.
- Sexual counseling and infertility.
- Genetic counseling of the infertile patient.
- Recipient counseling for donor insemination.
- Recipient counseling for egg donation.
- Embryo donation counseling.
- Ethical aspects of infertility counseling.
- Legal issues in infertility counseling.
- Assisted reproductive technology and the impact on children.

Paper 3. 2: Human Gamete and Embryo Culture System

(2 Credits - 2 Hours/Week) - 32 Hours

On successful completion of this course each student will be able to

- Know about historical backgrounds of gametes and embryo culture system.
- Understand utility of animal models for human embryo culture for media preparation.
- Learn more about medium used in embryo culture : single step and sequential medium.
- Maintain the proper air quality during embryo culture.

UNIT 1 **16 Hours**

- **Historical background of gametes and embryo culture:** Introduction, Development of culture media, The physiology of embryo culture, The maintenance of temperature, Optimization and regulation of pH in blood, Beer, and Embryos, The regulation of cellular volume and Osmolarity, The effects of environmental pollution and infection, The development of embryology specific tools, Recent changes to the IVF dish.
- **Utility of animal models for Human embryo culture Media composition:** Introduction, Rodents, Domestic Species and Nonhuman Primates.
- **Culture medium:** History of Embryo culture media, Salts and osmolarity, energy source and Metabolism, Effect of Osmolarity on Embryo development. **Amino acids and cellular homeostasis:** Macromolecules and embryo growth. Antioxidant chelater and cellular function. pH and buffers.
- **Growth factors:** Biochemical stress on the embryo, growth factors and embryo development, expression of growth factors in the reproductive tract, receptor expression by pre implantation embryos, Embryo coculture.

UNIT 2 **16 Hours**

- **Culture system:** Single step and sequential: introduction, Important components of culture media, Uses of single medium.
- **Embryo co-culture:** Introduction, prolonged culture time, Different technologies, co-culture and Blastocyst freezing,
- **Low-Oxygen Culture:** Introduction, Oxygen utilization, Production of reactive oxygen species, Harmful effects of ROS on cells, Protection against ROS, Low oxygen control of gene expression, Animal embryos developed in vitro at low versus high oxygen tension, Effect of oxygen concentration on animal in vitro maturation, Low versus high oxygen effect on human IVF outcome, Low oxygen during manipulation with oocytes and embryos, Minimal requirements for low oxygen culture.

- **Embryo density**: Introduction, embryo density and embryo culture in Invitro, increased embryo density and group culture, increased embryo density and individual embryo culture, dynamic embryo culture, static culture methods, good practices for preparing embryo culture dishes.
- **Air quality:** introduction, characterization and evaluation of air pollutants, the introduction of airborne contamination into the IVF laboratory. Airborne toxicant intrusion into the culture media, quantitative methods for studying airborne contamination, Designs for the control of airborne contamination, laboratory –specific air handling, VOC attenuation, culture system, general laboratory practices,
- **Culture system mineral oil overlay:** Introduction, types of oil, oil and contaminants, storage of oil, washing of oil,
- **Human embryo culture media comparison:** Introduction, facility requirements, reproductive medicine , facility requirements, IVF laboratory, methods, statistics,
- **Embryo culture and Epigenetics:** Introduction, embryo culture, epigenetic effects of embryo culture, epigenetic effects of culture media, epigenetic effects of serum, epigenetic effects of oxygen tension.

Semester III

Paper 3.3: Micromanipulation In ART (8 credits - 16 hours/week) 16 weeks

On successful completion of this course each student will be able to

- Understand the history and application of micro manipulation technique in ART.
- Know detailed account of various kinds of micro manipulation system.
- Learn how to align micro tool to handle human gametes.
- Understand how to carryout various advanced techniques using micromanipulator to improve the IVF success rate.

Practical-1

1. History of micromanipulation.
2. Various kinds of micromanipulation unit.
3. Detailed Account of all micro manipulation unit.
4. Micro tool preparation equipments.
5. Hands on practice of various micro manipulation unit.
6. Micro tool alignment.
7. Intra Cytoplasmic Sperm Injection (ICSI) dish preparation.
8. Brief Account on Poly Vinyl Pyrrolidone (PVP) and hyaluronidase.
9. Oocyte denudation.
10. Oocyte assessment.
11. Sperm immobilisation with various techniques.
12. Intra Cytoplasmic sperm injection.
13. Assisted hatching: Zona drilling, Zona thinning, Chemical and laser assisted hatching.
14. Intracytoplasmic Morphologically selected Sperm Injection (IMSI).
15. Physiological selection of Sperm and intra Cytoplasmic sperm injection (PICSI).
16. Spindle view (Polo-scope).
17. Time lapse video monitoring of developing embryo.

Semester III

Paper 3.4 : Cryobiology and Techniques (8 credits - 16 hours/week)16 weeks

On successful completion of this course each student will be able to

- Know the history of gamete cryopreservation and present practice how to cryopreserve human gametes and embryos
- Understand legal and ethical aspects of gamete banking
- Carryout cryopreservation by slow freezing and vitrification method successfully
- Understand how to cryopreserve various materials like sperm, testicular tissue, ovarian tissue.

Practical- 2

1. History of gamete cryopreservation.
2. Psychological and psychosocial issues surrounding sperm and egg banking.
3. Legal and ethical aspects of gamete banking.
4. Method of sperm retrieval and banking in cancer patients.
5. Detailed Account of cryoprotectant for slow freezing and vitrification method.
6. Dish preparation for freezing/vitrification.
7. Dish preparation for thawing/warming.
8. Advantages and disadvantages of slow freezing and vitrification method.
9. Oocyte/Sperm vitrification.
10. Cleavage stage embryo vitrification.
11. Blastocyst collapse and vitrification.
12. Trouble shooting in vitrification.
13. Ovarian tissue cryopreservation: Harvesting ovary.
14. Preparation and processing of ovarian cortex.
15. Vitrification of ovarian cortex.
16. Storage of vitrified ovarian cortex.
17. Warming of ovarian cortex.
18. Various equipments used for slow freezing.

Semester IV — 20 Credits

Paper 4.1: Preimplantation Genetic Screening (PGS)

(2 Credits- 2 hours/week) - 32 hours

On successful completion of this course each student will be able to

- Understand the history of Preimplantation genetic screening (PGS)
- Know about genetic basis of inherited technologies
- Understand in detail clinical aspects of Preimplantation genetics
- Perform biopsy for polar body and as well as cleavage &Blastocyst stage

UNIT 1 — **16 Hours**

- History of PGS: Animal studies and preclinical work, development of human embryo biopsy
- Genetic basis of inherited diseases.
- Prenatal screening and diagnosis.
- Preimplantation embryo development.
- Preimplantation genetics.
- Clinical aspects of Preimplantation genetics.

UNIT 2 — **16 Hours**

- Polar body biopsy.
- Cleavage stage embryo biopsy.
- Blastocyst biopsy .
- Preimplantation genetic diagnosis for infertility (PGS).
- Preimplantation genetic diagnosis for sex-linked disease and sex selection for nonmedical reasons.
- Genetic counseling.

Paper 4.2: Quality Control And Risk Management In ART

(2Credits - 2 Hours/Week) - 32 Hours

On successful completion of this course each student will be able to

- Understand about quality and quality management in ART laboratory.
- Know about regulation, licensing, accreditation and risk management in IVF laboratory.

- Learn about the parameters to run the successful laboratory.
- Understand about the third party reproduction and surrogacy bill.

UNIT 1 **16 Hours**

- Quality and quality management in ART laboratory.
- Regulation, licensing and accreditation.
- Risk and risk management in ART laboratory.
- Quality and risk management tool.
- Risk education/risk minimization.
- How do we manage risk, the benefit of risk management?
- Developing risk management programme.
- How are we doing bench marking?
- Human resources.

UNIT 2 **16 Hours**

- Parameters to run a successful laboratory.
- Mitochondrial replacement therapy in ART .
- Proteomics and Metabolomics .
- Indian Council of Medical Research (ICMR) guideline for ART unit, and regulation in assisted reproduction.
- Surrogacy Bill. ART Bill
- Artificial intelligence in ART
- Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Act.
- Regulation and ethics in clinical practice .
- Gamete and embryo donation.
- Regulation of ART Bank.
- ART Guideline worldwide
- ICMR Guideline for ART in India.
- Third party reproduction.
- Ethics in ART.
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Paper 4.3:Writing And Presentation Skill **(2 Credits)**

Students will select the appropriate topics related to ART under the guidance of a teacherandpreparethepowerpointpresentation.PreparedPPTwillbepresented.

Paper 4.4: PROJECT WORK **(10 credits)**

Students pursuing M.Sc in ART course required to carry out work on a selected research project under the guidance of the faculty. This is to train a post graduate student in research methods and techniques. Project work includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing research study, collection of data, data analysis and comparison of results and finally drawing conclusions.

The project should be written under the following headings

- Introduction.
- Aims of objective of the study.
- Review of literature.
- Material and Methods.
- Results.
- Discussion.
- Conclusion.
- Summary.
- Tables.
- Bibliography / Reference

Two copies of the project report have to be prepared and submitted to the department/university before the final examination date notified and it has to be evaluated by the examiners with project presentation and viva.

Scheme Of Examination - theory

C3 Total marks **70 marks**

Part-1 Short questions (**1 to 12 numbers**)

2x10 Questions (12 questions) **20 marks**

Answer any ten of the following

10x 2 Questions **20 Marks**
Write Long answer questions (21 to 24)

Answer any two of the following

Scheme of Examination- Practical

Reports – 40 marks

Viva- 30 marks

RECOMMENDED READING BOOKS

Sl.No.	Name of The Book	Authors	Edition And Year
1	Andrology Laboratory Manual	Ashok Agarwal, Kamini A Rao, M S Srinivas.	2010
2	A Practical Guide To Selecting Gametes And Embryos	Markus Montag.	2014
3	A Practical Guide To Basic Laboratory Andrology	Christopher L R Barratt ,David Mortimer , Jose Antonio Castilla ,Juan G.Alvarez,Lars Bjorndahl.	2010
4	A Workbook On Human Spermatozoa And Assisted Conception	Ashok Agarwal , Sonia Malik.	2012
5	Biennial Review Of Infertility	Bart C Fauser, Catherine Racowsky , Douglas T Carell, Peter N Schegel.	2013
6	Biochemistry	David Rawn, J.	1989
7	Biochemistry	Voet, D. And Voet, J.G.	1999
8	Biochemistry-The Chemical Reactions Of Living Cells- Vol-2.	David E. Metzle	1977
9	Biophysical Chemistry Part-2	Cantor And Schmmel.	1980
10	Biophysical Chemistry-Principles And Techniques.	Upadyaya And Upadyaya.	2003
11	Chemistry – An Introduction To General, Organic And Biological Chemistry.	Karen C. Timberlake	1999

13	Embryo Transfer	Gautam N Allahbadia	2008
14	Handbook Of Human Oocyte Cryopreservation	Eleonora Porcu , Patrizia Maria Ciotti, Stefano Venturoli	2013
15	Harrisons Endocrinology	J Larry Jameson	2010
16	Harper's Review Of Biochemistry, , (1997)	Murray Et. Al.	1997
17	Human Assisted Reproductive Technology: Future Trends In Laboratory And Clinical Practice.	Botros R. M.B. Rizk ,David K Gardner , , Tommaso Flcone .	2011
18	Infertility Counseling-A Comprehensive Handbook For Clinicians.	Linda Hammer Burns, Sharon N Covington	2006
19	Lehninger : Principles Of Biochemistry	David L Nelson, Michael M Cox	2015
20	Male Infertility , 2nd Edition ,	T B Hargreave .	1997
21	Medical Laboratory Technology Part-	S K. Mizanur Rahman.	2009
22	Molecular Biology Of The Cell.	Bruce Alberts	2002
23	Netters Atlas Of Human Embryology	Larry R Cochard	2002
24	Quality And Risk Management In The IVF Laboratory	David Mortimer And T. Mortimer	2008
25	Oocyte Biology In Fertility Preservation	S. Samuel Kim	2013
26	Sperm Banking –Theory And Practice	Allan A Pacey , Mathew J Tomlinson	2009
12	Embryo Culture: Methods And Protocols,	Gary D Smith, Jason E. Swain, Thomas B.Pool.	2013

27	Textbook Of IUI And ART	Hrishikesh Pai,Kinjal R Shah, Nanditha Palshetkar ,Rishma Dhillon Pai.	2016
28	Text Book Of Biochemistry With Clinical Correlations.	Thomas Devlin	1999
29	Textbook Of In Vitro Fertilization And Assisted Reproduction :The Bourn Hall Guide To Clinical And Laboratory Practice.3rd Edition	Peter R Brinsden	2005
30	The Sub fertility Handbook-A Clinicians Guide, 2ND Edition ,	Gab Kovacs .	2011
31	Textbook Of Assisted Reproductive Technologies: Laboratory And Clinical Perspectives. 3rd Edition	Ariel Weissman , Colin M Howeles , David K Gardner ,Zeev Shoham.	2009
32	Practical Manual Of In Vitro Fertilization.	Alex C. Varghese, Ashok Agarwal , Zsolt Peter Nagy	2013
33	Practical Biochemistry; Principles And Techniques;	K.Wilson And J. Walker (1995) 4 Th Edn.	1995
34	Preimplantation Genetic Diagnosis 2nd Edition	Joyce Harper	2009