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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(3)/2023-24** **Date: 04-11-2024**

## NOTIFICATION

Sub.: Syllabus and Examination pattern of **M.Sc. (Clinical Embryology and Assisted Reproductive Techniques)** course under Specialized Programme from the academic year 2024-25-reg.

Ref.: 1. Decision of the BOS Meeting held on 24-08-2024.
2. Decision of the Academic Council meeting held on 22-10-2024.

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The Board of Studies in **M.Sc. (Clinical Embryology and Assisted Reproductive Techniques) (PG)** at its meeting held on 24-08-2024 has resolved and recommended the Syllabus of **M.Sc. (Clinical Embryology and Assisted Reproductive Techniques)** course (CBCS Scheme) 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 Syllabus of **M.Sc. (Clinical Embryology and Assisted Reproductive Techniques)** 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. Ramachandra Kini, DoS in Biotechnology, Manasagangothri, Mysuru.
4. The Director, International Academy of Reproductive Sciences, Rajashekar Medical Foundation, # 272/2, 1st floor, T-Narasipura Road, Near Lalitha Mahal, Nadanahalli, 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.

**Proceedings of the meetings of the board of studies in MSc ( clinical Embryology and assisted reproductive techniques) ( PG).**
**International Academy of reproductive sciences, Rajshekar Medical foundation, # 272/2, first floor,**
**T Narasipura Road, near Lalitha Mahal, Nadanahalli, mysore-570028 was held on 24/08/2024 at 11:00 am.**
**Ref: UA-5/BOS/23/Spl./2023-24, Dated: 05-08-2024.**

**Members present:**

Prof. K Ramachandra Kini— Chairman BOS.

Dr. Yogitha Rao- Member

Dr Sanjay HR- Member

Mr. Deepak Gowda.- Member

**The meeting was initiated with a welcome speech by chairman of the board. The importance of the meeting was presented along with the agenda of framing, the syllabus and regulation for**
**Msc (clinical Embryology and assisted reproductive techniques) programme as per CBCS regulations of university of Mysore.**
**After detailed discussion among the members, the following were resolved to be recommended.**
**The proposed Msc (clinical Embryology and assisted reproductive techniques) programme offered under CBCS regulations, being followed by the University from time to time.**

Eligibility criteria, syllabus and methodology of assessment and evaluation for Msc (clinical Embryology and assisted reproductive techniques ) programme prepared and approved.
Finally, the chairman of BOS thanked all the members for their valuable time, support and valuable suggestions.

Prof. K. Ramachandra Kini

Chairman, BOS

# International Academy of Reproductive Sciences (IARS)

## Specialised Programme by University of Mysore
## MSc (Clinical Embryology and Assisted Reproductive Techniques)
## Scheme and Syllabus of Study (2024-2025 Batch)

**Preamble:**

The University of Mysore is offering postgraduate programme under the choice based credit system ( CBCS), with flexibility in curriculum, development and examination reforms in terms of adopting continuous evaluation pattern.

**Regulations:**

The MSc (Clinical Embryology and Assisted Reproductive Techniques), offered at IARS is approved by University of Mysore, vide ref. No- PMEB-1/01/Spl./2024-25 dated 18/07/2024.

This postgraduate programme follows University of Mysore regulations for choice based credit system (CBCS) and continuous assessment grading pattern(CAGP) with some minor modifications.

The course will have three components, namely

(i) Lecture-L (ii) Tutorial-T (iii) Practicals-P

**L** stands for lecture session. **T** stands for tutorial session, consisting participatory discussion/ self study/ brief seminar by students.

**P** stands for practice session, and it consists of hands-on experience/ laboratory experiments/ field studies/ case studies.

Every one hour session of L amounts to one credit per semester and a minimum of 2 hour session of T amounts to 1 credit per semester, over a period of one semester of 16 weeks for teaching learning process. The total duration of a semester is 20 weeks, inclusive of semester end examination.

The total credits earned by a student at the end of semester upon successfully completing the course are L+T+P. The credit pattern of the course is indicated as, L:T:P.

**Core Course:**

A course which should compulsorily be studied by a candidate as a core requirement is termed as a core course. A core course may be a **Soft Core**, if there is a choice or an option for a candidate to choose a course from a pool of courses from the main discipline/ or from a related discipline which supports the main subject. In contrast to the phrase **Soft Core**, a compulsory core course is called a **Hard-Core course.**

A **Soft Core Course** may also be considered as an **elective.**

**Project work/ Dissertation** work is a special course involving application of knowledge in solving/ analysing/ exploring a life situation/ difficult problem**. Major Project Work / Dissertation** work can be of 10 to 12 credits. A project / dissertation work may be a hard-core or a soft core as decided by the BOS concerned.

The credit pattern for Clinical Embryology and Assisted Reproductive Techniques is similar to the University's Choice Based Credit System (CBCS). The total credit for the course is same as that of PG programmes of the University.

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 ( 1:1).

**Tutorial and Practical :** At least two hour session of tutorial or practical per week in a semester is 1 credit (2:1).

**One semester period** is 16 weeks of teaching and learning.

**Duration of semester** is 20 weeks that includes semester end examinations.

- A Candidate can enrol for a minimum of 18 Credits per semester and maximum of 24 Credits per semester, for the first two semesters.
- A Candidate has to earn a minimum of 76 Credits for successful completion of a Masters degree.

**Eligibility for admission:** Students of Bachelors of Science degree from any UGC recognised Universities/MBBS/ BDS/ BAMS/ BHMS, B-Pharma, BMLT, BSc Nursing, BVSc, Dairy, Fishery and Engineering Biotechnology graduates are eligible. Students from Foreign National degree will apply through equivalence committee. Minimum percentage of marks is 50% in qualifying degree examinations ( 5% relaxation in case of SC/ST/Category-1).

Medium of instruction: English

Master's degree programme is of four semesters, two years duration.

**Continuous assessment, earning of credits and award of grades:**

The evaluation of the candidate shall be based on continuous assessment. The structure for evaluation is as follows.

Assessment and evaluation processes happen in a continuous mode. However, for reporting purposes, semester is divided into three discrete components identified as C1, C2 and C3.

The performance of a candidate in a course will be assessed for a maximum of hundred marks as explained below.

The first component C1, of assessment is for 15 marks. This will be based on test, assignment and seminar. During the first half of the semester, the first 50% of the syllabus will be completed. This shall be consolidated during the 8th week of the semester. Beyond 8th week, making changes in C1 is not permitted.

The second component C2 of assessment is for 15 marks. This will be based on test, assignment, seminar. The continuous assessment and scores of second half of the semester will be consolidated during 16th week of the semester. During the second half of the semester, the remaining units in the course will be completed.

During the 18th to 20th week of the semester, semester-end examination of three hours duration shall be conducted for each course. This forms the third / final component of the assessment (C3) and the maximum marks for the final component will be 70.

**Continuous Assessment Pattern:**

| Component | Syllabus in a course | Weightage | Marks Minimum | Period of continuous assessment |
|---|---|---|---|---|
| **C1** | First 50% | 15% | 4.5 | First half of the semester. To be consolidated by 8th week. |
| **C2** | Remaining 50% | 15% | 4.5 | Second half of the semester. To be consolidated by 16th week. |
| **C3** | Semester end examination (complete course content ) | 70% | 21 | To be completed during 18th to 20th week |

*** Minimum 30% & aggregate of 40% to declare pass.**

# International Academy of Reproductive Sciences

## Specialised Programme by University of Mysore

## Scheme of Study (2024-2025 batch)

**Masters degree program, MSc ( Clinical Embryology & Assisted Reproductive Techniques) recognised by University of Mysore:**

| Credits to be earned | 76 |
|---|---|
| Core papers | 64 credits |
| Soft core | 12 credits |

**Credit Matrix for master's degree programme:**

| Credits to be earned | I | II | III | IV | Total Credits |
|---|---|---|---|---|---|
| Hard core | 18 | 18 | 18 | 10 | 64 |
| Soft core | 3 | 3 | 3 | 3 | 12 |
| Total | 21 | 21 | 21 | 13 | 76 |

**Credit Distribution**

## I Semester (21 Credits)

| Sl. No. | Code | Title of the Paper | HC/SC | Credit pattern | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | | Andrology & Reproductive Biology | HC | 3 | 0 | 0 | 3 |
| 2 | | Reproductive Endocrinology & Reproductive Disorders | HC | 3 | 0 | 0 | 3 |
| 3 | | Practical-1 Basic & Advanced Andrology Techniques | HC | 0 | 0 | 6 | 6 |
| 4 | | Practical-2 Cell Biology & Sterilisation Techniques | HC | 0 | 0 | 6 | 6 |
| 5 | | Clinical ART & Fertility Drugs | SC | 3 | 0 | 0 | 3 |
| | | | | | | | **21** |

## II Semester (21 credits)

| Sl. No. | Code | Title of the Paper | HC/SC | Credit pattern | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | | Fertility Preservation Techniques & Biobanking | HC | 3 | 0 | 0 | 3 |
| 2 | | ART-Act, Documentation & Laboratory Management | HC | 3 | 0 | 0 | 3 |
| 3 | | Practical-3 IVF Laboratory Techniques | HC | 0 | 0 | 6 | 6 |
| 4 | | Practical-4 Cryopreservation Techniques | HC | 0 | 0 | 6 | 6 |
| 5 | | Research Methodology & Publication in Reproductive Medicine | SC | 3 | 0 | 0 | 3 |
| | | | | | | | **21** |

## III Semester (21 credits)

| Sl. No. | Code | Title of the Paper | HC/SC | Credit pattern | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | | Assisted Reproductive Techniques & Emerging Technologies in ART | HC | 3 | 0 | 0 | 3 |
| 2 | | Genetics in Reproduction | HC | 3 | 0 | 0 | 3 |
| 3 | | Practical-5 Advanced ART Laboratory Procedures | HC | 0 | 0 | 6 | 6 |
| 4 | | Practical-6 Embryo Biopsy Techniques | SC | 0 | 0 | 6 | 6 |
| 5 | | Regenerative Medicine in Reproduction & Scientific Writing | SC | 3 | 0 | 0 | 3 |
| | | | | | | | **21** |

## IV Semester ( 10 credits)

| **Sl. No.** | **Code** | **Title of the Paper** | **HC/SC** | **Credit pattern** | | | **Credits** |
|---|---|---|---|---|---|---|---|
| | | | | **L** | **T** | **P** | |
| 1 | | Scientific writing & Presentation Skill | SC | 0 | 3 | 0 | **3** |
| 2 | | Research Project Work / Dissertation | HC | 0 | 2 | 8 | **10** |
| | | | | | | | **13** |

# Syllabus of Study

## Semester I
## Paper-1
## Andrology & Reproductive Biology (HC)

32 Hours

### Unit-1

- History of IVF
- Mammalian cell biology
- Somatic cells
- Cell membranes
- ER, microvilli, cell cytoplasm, microtubules, microfilaments, centrioles, nucleus
- Active, and inactive chromatin
- Mitochondria
- Nuclear RNA, RER & SER, Golgi apparatus,
- Metabolism of cell, ROS, SOD ( super oxide, disputant)
- Methylation,
- DNA replication
- Homeobox genes
- Ribosomal RNA, messenger RNA
- Transcription in oocytes, translation-protein synthesis
- Cellular replication, mitosis, meiosis
- Chromosomes, chromatin, chromatids, centromere, kinetochore, diploid, haploid, aneuploid ,
- HeLa cells.

### Unit-2

**Gross anatomy, and histology**
**Male reproductive anatomy**

- Testicular Anatomy: Structure of the testes, including seminiferous tubules and rete testis.

- Epididymis: Anatomy and its role in sperm maturation.
- Vas Deferens: Structure and its role in sperm transport.
- Prostate Gland: Anatomical features and its role in seminal fluid production.
- Seminal Vesicles: Anatomy and function in the production of seminal fluid.
- Penile Structure: Anatomy of the penis, focusing on erectile tissues (corpora cavernosa and corpus spongiosum).
- Scrotal Anatomy: Structure and function in temperature regulation for spermatogenesis.

**Female Reproductive Anatomy**:

- Ovarian Anatomy: Structure of the ovary, including follicles, corpus luteum, and stroma.

- Fallopian Tubes: Anatomy and their role in oocyte transport and fertilization.
- Uterine Anatomy: Structure of the uterus, including myometrium, endometrium, and uterine cavity.
- Cervix: Anatomy of the cervix, including the cervical canal and external os.
- Vaginal Anatomy: Structure of the vagina and its role in reproduction.

- Broad Ligament and Supporting Structures: Anatomy of the ligaments that support the female reproductive organs
- Oogenesis Overview: Stages from oogonia to the mature oocyte.
- Primordial Germ Cells: Origin, migration, and differentiation into oogonia.
- Folliculogenesis: Development and maturation of ovarian follicles.
- Meiotic Arrests in Oogenesis: Mechanisms and significance of prophase I and metaphase II arrests.
- Role of Granulosa Cells: Function in supporting oocyte development and follicular maturation.
- Hormonal Regulation of Oogenesis: Influence of FSH, LH, and estrogen on follicular development.
- Cytoplasmic Maturation: Importance of cytoplasmic changes in oocyte quality.
- Ovulation Mechanism: Processes leading to the release of the oocyte from the ovary.
- Atresia: Mechanisms of follicular atresia and its impact on oocyte reserve.
- Oocyte-Somatic Cell Interactions: Communication between the oocyte and surrounding granulosa and theca cells.
- Epigenetic Modifications in Oogenesis: Role in the regulation of oocyte development and early embryo development

## Unit -3

**Andrology**

- Spermatogenesis Overview: Detailed stages of spermatogenesis, from spermatogonia to spermatozoa.
- Spermatogonial Stem Cells: Characteristics, types, and role in the initiation of spermatogenesis.
- Role of Sertoli Cells: Function in supporting spermatogenesis and maintaining the blood-testis barrier.
- Meiotic Division in Spermatogenesis: Chromosomal crossover, segregation, and genetic diversity.
- Spermiogenesis: Transformation of spermatids into mature spermatozoa.
- Hormonal Regulation of Spermatogenesis: The influence of FSH, LH, and testosterone.
- Testicular Microenvironment: The role of the testicular niche in regulating spermatogenesis.
- Epididymal Maturation: Processes involved in sperm maturation within the epididymis.
- Spermatogenic Cycle: The timing and coordination of spermatogenic stages.
- Spermatogenic Wave: The spatial organization of spermatogenesis along the seminiferous tubules.
- Genetic and Epigenetic Regulation: Influence on spermatogenesis and male fertility.
- Environmental and Lifestyle Factors: Impact on spermatogenesis and sperm quality.
- Cryopreservation of Sperm: Techniques, challenges, and applications in fertility preservation.
- Sperm DNA Integrity: Assessment of DNA damage and its impact on fertility.
- Impact of Age on Spermatogenesis: Age-related changes in sperm production and quality.
- Spermatogenesis: Molecular and cellular mechanisms
- Exploration of the stages and regulatory factors involved in sperm production.
- Male Infertility: Genetic and Environmental Factors
- Assisted Reproductive Technologies (ART) and Male Infertility
- Techniques like ICSI (Intracytoplasmic Sperm Injection)
- Sperm cryopreservation techniques
- Methods for long-term storage of sperm and implications for fertility treatments.
- Epigenetic Modifications in Sperm and implications for offspring health

- How epigenetic changes in sperm can affect embryonic development and long-term health.
- Role of Oxidative Stress in Male Reproductive Health
- The impact of reactive oxygen species on sperm function and male fertility.
- Y-Chromosome Microdeletions and Their Role in Male Infertility
- Genetic defects in the Y chromosome and their implications for reproduction.
- Hormonal Regulation of Male Reproduction
- The roles of testosterone, FSH, LH, and other hormones in male reproductive health.
- Male Reproductive Tract Infections and Their Impact on Fertility
- How infections like STIs affect male reproductive organs and sperm quality.
- Sperm DNA Fragmentation and Its Effect on Fertility Outcomes

## Unit-4

- Fertilisation
- Sequential events from sperm-oocyte interaction to zygote formation.
- Sperm Capacitation:
- Biochemical changes enabling sperm to fertilize the oocyte.
- Acrosome Reaction: Mechanisms and significance in sperm penetration of the oocyte.
- Zona Pellucida Binding: Molecular interactions between sperm and zona pellucida.
- Sperm-Oocyte Fusion: Cellular and molecular mechanisms involved in the fusion process.
- Oocyte Activation: Events triggered in the oocyte upon sperm entry, including calcium oscillations.
- Cortical Reaction: Prevention of polyspermy and the modification of the zona pellucida.
- Pronuclear Formation: Formation and migration of male and female pronuclei.
- Syngamy: Fusion of the male and female pronuclei and the formation of the zygote.
- Role of Ion Channels: Regulation of fertilization by ion fluxes, particularly calcium signaling
- Early development of embryo:
- Cleavage and Blastulation: Stages of rapid cell division leading to the formation of the blastocyst.
- Compaction: Mechanisms and significance in the early development of the morula.
- Formation of the Blastocyst: Differentiation into the inner cell mass and trophoblast.
- Embryonic vs. Extraembryonic Lineages: Early lineage segregation and its implications.
- Hatching of the Blastocyst: Processes involved in the release of the blastocyst from the zona pellucida.
- Implantation: Mechanisms of blastocyst attachment and invasion into the uterine lining.
- Trophoblast Differentiation: Formation of the cytotrophoblast and syncytiotrophoblast.
- Gastrulation: Formation of the three germ layers (ectoderm, mesoderm, endoderm) and their significance.

## Paper-2

## Reproductive Endocrinology and Reproductive Disorders ( HC)

**32 Hours**

### Unit-1

Endocrinology :

- Hypothalamic-Pituitary-Gonadal (HPG) Axis: Regulation of reproductive hormones and feedback mechanisms.
- Gonadotropin-Releasing Hormone (GnRH): Role in the control of FSH and LH secretion.
- Follicle-Stimulating Hormone (FSH): Function in gametogenesis and its regulation by feedback mechanisms.
- Luteinizing Hormone (LH): Role in ovulation, corpus luteum formation, and testosterone production.
- Estrogen and Progesterone: Their roles in the menstrual cycle, pregnancy, and secondary sexual characteristics.
- Testosterone and Androgens: Regulation of male reproductive function and secondary sexual characteristics.
- Hormonal Regulation of Menstrual Cycle: Interaction between estrogen, progesterone, FSH, and LH.
- Endocrine Control of Puberty: Hormonal changes that initiate and regulate puberty.
- Hormonal Changes in Pregnancy: Role of hCG, estrogen, progesterone, and prolactin in maintaining pregnancy
- Thyroid & adrenal glands

- Endocrine disorders affecting the fertility.

### Unit-2

Physiology of puberty

- Onset of Puberty: The role of genetic, environmental, and nutritional factors in the timing of puberty.
- Hypothalamic Maturation: Activation of the hypothalamic-pituitary-gonadal (HPG) axis and its role in initiating puberty.
- Gonadarche: The role of gonadal hormones (testosterone in males, estrogen in females) in the development of secondary sexual characteristics.
- Adrenarche: The increase in adrenal androgen production and its contribution to pubic and axillary hair development.
- Growth Spurt: Hormonal regulation of the rapid increase in height and changes in body composition during puberty.
- Sexual Maturation: The physiological changes leading to reproductive capability, including spermatogenesis and menarche.
- Regulation of GnRH Secretion: The role of kisspeptin and other neuroendocrine signals in the pulsatile release of GnRH.

### Unit-3

Physiology of male reproductive system:

- Functional anatomy
- spermatogenesis and its regulation

- male reproductive hormones
- sperm structure and function
- abnormality in semen analysis
- Spermatogenesis: The process of sperm production, including hormonal regulation by FSH and testosterone.
- Role of Testosterone: Effects on spermatogenesis, secondary sexual characteristics, and overall male reproductive function.
- Erection and Ejaculation: Physiological mechanisms involved in penile erection and the ejaculatory process.
- Semen Production and Composition: The contribution of the testes, seminal vesicles, prostate gland, and bulbourethral glands to semen.
- Hormonal Feedback Mechanisms: The regulation of testosterone levels and spermatogenesis by the hypothalamic-pituitary-gonadal axis.
- Sperm Transport and Maturation: The role of the epididymis, vas deferens, and accessory glands in sperm maturation and delivery.

physiology of female reproductive system:
- Functional anatomy,
- oogenesis, and regulation,
- female reproductive hormones,
- menstrual cycle,
- ovulation,
- fertilisation,
- implantation.

## Unit-4

**Reproductive Disorders**

- Sexual differentiation & developmental abnormalities – male & female
- Menstrual disorders – Precocious, delayed or absent puberty; Amenorrhea, menorrhagia, DUB
- Fertility disorders – Sexual dysfunction; Infertility; Spontaneous pregnancy loss
- Endocrine disorders – Hyperprolactinemia
- Autoimmune disorders
- Genetic disorders (mutations and syndromes)
- Cancers and biomarkers – Testicular; Prostate; Ovarian; Endometrial; Cervical;
- Breast
- Reproductive pathology
- Medical management of reproductive disorders

## Paper-3
## Clinical ART and Fertility Drugs (SC)

**32 Hours**

### Unit-1

Hormonal Preparations in ART

- Overview of Hormonal Regulation
  - Physiology of the menstrual cycle
  - Role of key hormones: FSH, LH, estradiol, progesterone
- Gonadotropins and Their Role in ART
  - Types of gonadotropins: recombinant vs. urinary
  - Mechanism of action and dosage considerations
  - Risks and side effects
- GnRH Agonists and Antagonists
  - Mechanism of action and clinical application
  - Differences between agonists and antagonists
  - Preventing premature LH surge and luteinisationStimulation Protocols in ART
- Overview of Controlled Ovarian Hyper stimulation (COH)
  - Objectives and outcomes of COH
  - Patient assessment and protocol selection
- Long Protocol
  - GnRH agonist down regulation
  - Step-by-step protocol and monitoring
- Antagonist Protocol
  - Protocol outline and indications
  - Advantages and disadvantages
- Mild Stimulation Protocols
  - Rationale for mild stimulation
  - Protocol variations and patient selection
- Management of Poor Responders
  - Adjusting stimulation protocols for poor ovarian reserve
  - Use of adjuvant therapies in poor respondersUltrasound in ART
- Basics of Reproductive Ultrasound
  - Types of ultrasound used in ART: transvaginal, Doppler
  - Follicular monitoring: techniques and interpretation
- Endometrial Assessment
  - Measuring endometrial thickness and pattern
  - Correlation with implantation potential
- Ovarian and Follicular Assessment
  - Antral follicle count (AFC) and ovarian reserve testing
  - Monitoring follicular growth during COH

### Unit-2

- Oocyte Pickup
  - Preparation for Oocyte Retrieval

- Preoperative evaluation and patient preparation
- Sedation and anaesthesia options
- Oocyte Retrieval Procedure
    - Step-by-step guide to transvaginal oocyte retrieval
    - Techniques for minimising complications
- Post-Retrieval Care
    - Managing patient recovery and addressing complications
    - Oocyte assessment and handling in the lab

- Embryo Transfer
    - Preparation for Embryo Transfer
        - Criteria for selecting embryos for transfer
        - Endometrial preparation and synchronisation
    - Embryo Transfer Techniques
        - Step-by-step embryo transfer procedure
        - Role of ultrasound guidance in embryo transfer
        - Factors influencing embryo transfer success
    - Post-Transfer Care
        - Luteal phase support protocols
        - Patient instructions and monitoring
- Donor Cycle
    - Overview of Donor Programs
        - Indications for donor egg/sperm/embryo cycles
        - Ethical and legal considerations in donor programs
    - Donor Selection and Screening
        - Criteria for selecting donors
        - Genetic and infectious disease screening
    - Synchronising Donor and Recipient Cycles
        - Hormonal preparation of the recipient
        - Timing and coordination of donor and recipient cycles
- Surrogacy
    - Introduction to Surrogacy
        - Types of surrogacy: gestational vs. traditional
        - Indications and legal considerations
    - Surrogacy Process and Protocols
        - Selecting and screening surrogates
        - Medical protocols for surrogate preparation
    - Ethical and Legal Aspects
        - Consent, contracts, and legal requirements
        - Managing relationships between intended parents and surrogates

## Unit-3

Fertility Drugs

- Introduction to Fertility Drugs

- Overview of Pharmacology in ART
  - Mechanisms of action of fertility drugs
  - Pharmacokinetics and pharmacodynamics
- Regulation and Safety of Fertility Drugs
  - Regulatory bodies and guidelines
  - Drug safety, side effects, and patient education
- Gonadotropins in ART
  - Types of Gonadotropins
    - Recombinant vs. urinary gonadotropins
    - Comparative effectiveness and dosing strategies
  - Clinical Use in Stimulation Protocols
    - Dosing regimens and monitoring response
    - Management of gonadotropin side effects
- GnRH Agonists and Antagonists
  - Mechanism of Action
    - Role in preventing premature LH surge
    - Protocols involving GnRH agonists and antagonists
  - Managing Side Effects
    - Identifying and managing common side effects
    - Long-term effects of GnRH analogs
- Clomiphene Citrate and Letrozole
  - Mechanism of Action and Use
    - Clomiphene citrate: indications, protocols, and outcomes
    - Letrozole: comparison with clomiphene citrate
  - Side Effects and Complications
    - Managing adverse effects
    - Impact on endometrial lining and ovulation

## Unit-4

- Luteal Phase Support
  - Role of Progesterone in ART
    - Mechanism of action in luteal support
    - Different forms of progesterone: oral, vaginal, injectable
- Role of HCG in luteal support
  - Luteal Support Protocols
    - Timing and duration of luteal phase support
    - Adjusting luteal support based on patient response
- FET treatment protocols
  Natural cycles,
  Modified natural cycle,
  HRT cycles
- Adjuvant Therapies in ART
  - Use of Metformin, DHEA, and Aspirin
    - Role in specific patient populations (e.g., PCOS, poor responders)
    - Evidence-based use and outcomes

- Emerging Adjuvant Therapies
  - Antioxidants, immunomodulators, and growth hormones
  - Evaluating the evidence and clinical applications

## Practical-1

## Basic & Advanced Andrology Techniques ( HC)

- Fundamental laboratory skills such as pipetting, microscopy,
- Handling biological samples with precision and care.
- Staining techniques,
- Differentiation and identification of different cells
- Semen Analysis: Basic evaluation of sperm count, motility, morphology, and volume.
- Sperm Motility Tests: Assessing progressive and non-progressive motility, including computer-assisted sperm analysis (CASA).
- Sperm Viability Tests: Evaluation of live versus dead sperm using techniques like the eosin-nigrosin stain or hypo-osmotic swelling test.
- Sperm Morphology Assessment: Detailed analysis of sperm shape and structure using strict (Kruger) criteria.
- Acrosome Reaction Test: Determining the ability of sperm to undergo the acrosome reaction, essential for fertilization.
- Sperm DNA Fragmentation Tests: Assessment of DNA integrity using tests like the TUNEL assay, SCSA, or COMET assay.
- Reactive Oxygen Species (ROS) Testing: Evaluating oxidative stress levels and their impact on sperm function.
- Sperm Chromatin Structure Assay (SCSA): Analyzing chromatin integrity and its relation to fertility.
- Capacitation and Hyperactivation Tests: Assessing sperm's ability to undergo capacitation and achieve hyperactivated motility.
- Zona Pellucida Binding Assay: Testing sperm's ability to bind to the zona pellucida of the oocyte.
- Sperm Penetration Assay (SPA)
- Testicular sperm extraction (TESE) and micro dissection TESE (micro-TESE) sperm preparation techniques.
- cryopreservation methods for sperm storage

## Practical -2

# Cell biology and sterilisation techniques

**Cell Biology Techniques:**

- Microscope, handling and use
- Cell observation and differentiation
- Bright field microscopy
- Phace contrast microscope
- Stereo zoom microscope
- Invert microscope
- Basic staining techniques, simple staining, Gram staining, vital staining.
- Haemocytometer use
- Serial dilution to obtain accountable concentration
- Preparation of culture media
- Buffer preparations
- Aseptic laboratory techniques
- Simple DNA extraction
- Observation of mitosis

**Sterilisation Techniques:**

- Sterilisation of Laboratory Equipment: Methods for sterilising culture dishes, pipettes, and other lab tools to prevent contamination.
- Sterilisation of Culture Media: Techniques such as filtration and autoclaving to ensure sterility of culture media used in IVF.
- Aseptic Technique in IVF Labs: Best practices to maintain a sterile environment during gamete handling and embryo culture.
- Sterilisation Protocols for Incubators: Regular maintenance and sterilisation techniques to prevent microbial contamination in embryo incubators.
- UV Sterilisation: The use of ultraviolet light to sterilise work surfaces and air in the IVF lab.
- Sterilisation of Cryopreservation Equipment: Ensuring sterility in cryovials and storage tanks.
- Sterilisation of Surgical Instruments: Techniques used to sterilise instruments for procedures such as egg retrieval.
- Air Filtration and Sterilisation: The role of HEPA filters and laminar flow hoods in maintaining sterile air quality in IVF labs.

- Sterilisation of Consumables: Methods for ensuring single-use consumables are sterile before use in IVF procedures.
- Different sterilisation techniques
- autoclaving,
- heat sterilisation,
- chemical sterilisation
- preparation of culture media for IVF and andrology
- understanding the specific nutritional and environmental needs of cells and the importance of maintaining pH, osmolarity, and sterility.

## Semester-II

Paper-1

## Fertility Preservation Techniques & Biobanking ( HC)

**32 Hours**

### Unit-1

**Fertility Preservation Techniques**

- Introduction to Fertility Preservation
    - Overview of fertility preservation
    - Indications for fertility preservation
    - Ethical considerations and patient counselling
- Cryopreservation of Gametes
    - Sperm cryopreservation: techniques, protocols, and clinical applications
    - Oocyte cryopreservation: methods, success rates, and challenges
    - Vitrification vs. slow freezing
- Ovarian Tissue Preservation
    - Techniques of ovarian tissue cryopreservation
    - Indications and clinical outcomes
    - Transplantation of cryopreserved ovarian tissue
- Testicular Tissue Preservation
    - Testicular tissue cryopreservation and its clinical applications
    - Challenges in prepubertal male fertility preservation
    - Future directions and research
- Fertility Preservation in Cancer Patients

- Impact of cancer treatments on fertility
- Timing and decision-making for fertility preservation
- Special considerations in paediatric oncology
  - 

## Unit-2

**Biobanking in Reproductive Medicine**

- Introduction to Biobanking
  - Definition and scope of biobanking
  - Importance of biobanking in reproductive medicine
  - Regulatory and ethical considerations in biobanking
- Sample Collection and Processing
  - Types of samples: gametes, embryos, tissues
  - Standard operating procedures for collection, handling, and storage
  - Quality control and assurance in biobanking
- Legal and Ethical Aspects
  - Consent and legal issues in fertility preservation
  - Ethical dilemmas and decision-making in clinical practice

## Unit-3

- Cryopreservation and Storage
  - Principles of cryopreservation in biobanking
  - Long-term storage techniques and management
  - Thawing and recovery of stored samples
- Documentation
  - Documentation and record-keeping protocols
  - Privacy, confidentiality, and data security
- Legal, Ethical, and Social Implications
  - Consent, ownership, and access to biobanked materials
  - Ethical considerations in reproductive biobanking
  - International guidelines and best practices
- Future Directions in Biobanking
  - Innovations in cryopreservation technologies
  - Emerging trends in biobanking research
  - Biobanking and personalised medicine

## Unit-4

**Embryo Metabolism**

- Introduction to Embryo Metabolism
  - Basic concepts of metabolism in early embryonic development

- Metabolic pathways and their regulation in embryos
- Energy requirements during preimplantation development

- Carbohydrate Metabolism in Embryos
  - Role of glucose and other sugars in embryo development
  - Glycolysis, the pentose phosphate pathway, and oxidative phosphorylation
  - Impact of culture media on embryo carbohydrate metabolism
- Amino Acid and Protein Metabolism
  - Amino acid metabolism and its role in embryonic growth
  - Protein synthesis and degradation in embryos
  - Influence of culture conditions on amino acid metabolism
- Lipid Metabolism in Embryos
  - Importance of lipids in embryo development
  - Lipid synthesis, oxidation, and storage in embryos
  - Impact of maternal diet and culture media on lipid metabolism
- Embryo Culture Conditions and Metabolic Health
  - The effect of oxygen tension on embryo metabolism
  - The role of antioxidants and metabolic modulators in culture media
  - Assessing embryo metabolic health as a predictor of viability
- 6. Proteomics & secretomics in IVF
- 7. Co culture in IVF

## Paper-2

## ART Act, Documentation & Laboratory Management ( HC)

**32 Hours**

### Unit-1:

**ART-Act:**

- Introduction to the ART Act
  - Overview of the Assisted Reproductive Technology (ART) Act
  - Objectives and scope of the Act
  - Historical development and legislative framework
- Regulatory Bodies and Their Roles
  - National and state-level ART regulatory authorities
  - Roles and responsibilities of regulatory bodies
  - Licensing and accreditation procedures
- Legal and Ethical Aspects of ART
  - Patient rights and confidentiality
  - Ethical considerations in ART practices
  - Consent and counselling requirements
- Standards and Guidelines
  - Standards for ART clinics and laboratories
  - Quality control and assurance guidelines
  - Monitoring and evaluation of ART services

- Third-Party Reproduction
    - Regulations on egg, sperm, and embryo donation
    - Legal aspects of surrogacy arrangements
    - Rights and responsibilities of donors and surrogates
- ART Act Compliance and Reporting
    - Compliance requirements for ART practitioners
    - Documentation and reporting obligations
    - Penalties for non-compliance

## Unit-2

**Documentation in IVF Lab**

- Importance of Documentation in IVF Labs
    - Role of documentation in ensuring quality and safety
    - Regulatory and legal requirements for documentation
    - Best practices for maintaining accurate records
- Types of Documentation
    - Patient records and consent forms
    - Laboratory protocols and standard operating procedures (SOPs)
    - Equipment maintenance and calibration logs
- Data Management Systems
    - Electronic medical records (EMR) and laboratory information systems (LIS)
    - Data entry and retrieval processes
    - Ensuring data integrity and security
- Patient Identification and Tracking: Systems and protocols for ensuring accurate patient identification throughout the IVF process.
- Cycle Monitoring Documentation: Recording hormone levels, ultrasound findings, and medication protocols during the IVF cycle.
- Gamete and Embryo Handling Records: Detailed logs of oocyte retrieval, sperm processing, fertilization outcomes, and embryo culture.
- Embryo Grading and Development Tracking: Documentation of embryo quality, grading criteria, and development milestones.
- Cryopreservation Records: Detailed documentation of embryos or gametes that are cryopreserved, including storage location and thawing records.

## Unit-3

- Equipment Maintenance Logs: Keeping records of routine maintenance, calibration, and sterilization of lab equipment.
- Quality Control Documentation: Records of quality control measures, including media testing, temperature monitoring, and pH checks.
- Compliance and Regulatory Documentation: Ensuring adherence to legal and ethical guidelines, including informed consent forms and regulatory compliance records.
- Embryo Transfer Documentation: Recording the details of the embryo transfer procedure, including the number of embryos transferred and the catheter used.

- Quality Control and Assurance Documentation
    - Recording quality control measures and results
    - Documentation of quality assurance activities
    - Auditing and reviewing documentation
- Confidentiality and Data Protection
    - Ensuring patient confidentiality in documentation
    - Legal requirements for data protection
    - Strategies for safeguarding sensitive information
- Incident and Error Reporting: Documentation of any deviations from protocol, incidents, or errors in the lab, along with corrective actions taken.
- Troubleshooting and Incident Reporting
    - Documenting deviations and non-conformities
    - Incident reporting and corrective action plans
    - Learning from errors and improving practices

## Unit-4

**Management in IVF**

- IVF Clinic Management
    - Organisational structure and roles in an IVF clinic
    - Leadership and team management
    - Strategic planning and resource allocation
- Human Resource Management
    - Recruitment and training of staff
    - Performance management and appraisal
    - Staff retention and motivation
- Patient Management and Communication
    - Patient flow and appointment scheduling
    - Patient education and informed consent
    - Communication skills and patient interaction
- Quality Management Systems
    - Implementing quality management systems in IVF clinics
    - Continuous quality improvement strategies
    - Accreditation and certification processes
- Risk Management and Compliance
    - Identifying and assessing risks in IVF practice
    - Developing risk management plans
    - Ensuring compliance with legal and regulatory requirements

Paper-3

## Research Methodology & Publication in Reproductive Medicine (SC)

**32 Hours**

### Unit-1

**Research Methodology**

- Introduction to Research Methodology
    - Definition and importance of research
    - Types of research (qualitative, quantitative, mixed methods)
    - Steps in the research process
- Formulating Research Questions and Hypotheses: Developing clear and testable research questions and hypotheses.
- Study Design: Overview of various research designs, including experimental, observational, cross-sectional, and longitudinal studies.
- Sampling Techniques: Methods for selecting representative samples, including random, stratified, and convenience sampling.
- Data Collection Methods: Techniques for gathering data, including surveys, interviews, observations, and experiments.
- Quantitative vs. Qualitative Research: Differences in approach, data analysis, and interpretation between quantitative and qualitative research.
- Statistical Analysis: Basic and advanced statistical methods for analyzing research data, including descriptive and inferential statistics.
- Validity and Reliability: Ensuring the accuracy and consistency of research findings, including internal and external validity.
- Ethical Considerations in Research: Principles of ethical research, including informed consent, confidentiality, and the treatment of human subjects.
- Literature Review: Conducting a comprehensive review of existing research to inform and contextualize your study.
- Writing a Research Proposal: Key components of a research proposal, including the introduction, methodology, expected outcomes, and budget.

### Unit-2

**Data collection methods:**

- Surveys and Questionnaires: Design, administration, and analysis of surveys to gather quantitative or qualitative data.
- Interviews: Techniques for conducting structured, semi-structured, and unstructured interviews to collect in-depth qualitative information.
- Focus Groups: Methods for organizing and moderating group discussions to gather collective insights and opinions.
- Observational Methods: Techniques for collecting data through direct observation of subjects in natural or controlled settings.
- Experiments: Design and execution of controlled experiments to test hypotheses and observe causal relationships.
- Case Studies: In-depth analysis of individual cases or small groups to gain a comprehensive understanding of specific phenomena.

- Longitudinal Studies: Methods for collecting data over extended periods to observe changes and developments over time.
- Cross-Sectional Studies: Collection of data at a single point in time to assess relationships between variables.
- Secondary Data Analysis: Using existing data from previous research, databases, or records for new analyses.

**Literature Review:**

- Purpose and Scope of a Literature Review: Understanding the role of a literature review in providing context and background for research.
- Search Strategies: Techniques for systematically searching academic databases, journals, and other sources for relevant literature.
- Inclusion and Exclusion Criteria: Criteria for selecting and filtering relevant studies for review based on research questions and objectives.
- Critical Appraisal: Evaluating the quality and credibility of research articles, including assessment of methodology, results, and conclusions.
- Thematic Analysis: Identifying and organizing key themes, trends, and patterns in the literature.
- Synthesis of Findings: Summarizing and integrating findings from multiple studies to draw overall conclusions and identify gaps.
- Citation Management: Using tools and software for managing references and citations, such as EndNote, Zotero, or Mendeley.
- Writing the Literature Review: Structuring and composing the review, including introduction, thematic organization, critical analysis, and synthesis of findings.

**Reviewing Methodologies:** Understanding different methodologies used in the studies reviewed and their implications for your own research.

## Unit-3

**Plagiarism**

- Writing and Publishing Research
    - Structure of a research paper
    - Writing abstracts and conclusions
    - Choosing appropriate journals for publication
- . Plagiarism
- Understanding Plagiarism
    - Definition and types of plagiarism
    - Consequences of plagiarism in academia
    - Examples of plagiarism in scientific research
- Avoiding Plagiarism
    - Proper citation and referencing
    - Paraphrasing and summarising techniques
    - Using plagiarism detection tools
- Ethical Writing Practices
    - Authorship and contributor ship
    - Acknowledging sources and collaborators
    - Reproducibility and transparency in research
- Institutional Policies on Plagiarism

- University guidelines and policies
- Handling allegations of plagiarism
- Educational programs on academic integrity
- Logistic regression
- Survival analysis

## Unit-4

**Publication**

- Authorship Criteria and Responsibilities: Guidelines for determining who qualifies as an author and their responsibilities in a publication.
- Plagiarism and Data Fabrication: Ethical issues related to copying others' work or fabricating data, and how to avoid them.
- Conflicts of Interest: Identifying and disclosing financial, personal, or professional conflicts that could influence research outcomes.
- Peer Review Ethics: Ethical considerations in the peer review process, including confidentiality and unbiased evaluation.
- Informed Consent in Human Research: Ensuring that participants understand and agree to the research, with a focus on publication ethics.
- Transparency in Data Reporting: The importance of accurately and fully reporting research methods and findings.
- Duplicate Publication and Self-Plagiarism: Ethical issues related to publishing the same research in multiple journals or republishing one's own work without proper citation.
- Open Access vs. Traditional Publishing: Ethical considerations in choosing between open access and traditional journals, including issues of accessibility and cost.
- Retraction and Correction of Published Work: The ethical process for retracting or correcting errors in published research.
- Ethical Use of AI and Software in Research: Guidelines for the responsible use of artificial intelligence and software tools in research and publication.

## Practical -3 ( HC)

## IVF LaboratoryTechniques

- Dish reparation for IVF & ICSI,
- Equilibration of dishes & tubes containing media,
- Preparation of laboratory for oocyte pick-up,
- Follicular fluid screening for COC, denudation of oocytes, quality assessment,
- Preparation for fertilisation through techniques such as conventional IVF and Intracytoplasmic Sperm Injection (ICSI)
- Embryo culture
- Monitoring development stages
- Embryo grading & selection
- Cryopreservation techniques for sperm, oocytes, and embryos
- Thawing and post-thaw assessments
- Proficiency in the cryopreservation and thawing techniques for sperm, oocytes, and embryos
- Understanding of the critical parameters affecting the success of cryopreservation.
- Ability to assess post-thaw viability and implement quality control in cryopreservation practices.
- Record all cryopreservation and thawing procedures meticulously.

- Assess the survival rate, morphology, and potential developmental competence of thawed oocytes
- Grade the thawed embryos and monitor their development in culture.
- Quality control measures to ensure consistency and reliability.
- Review and analyse outcomes to optimise protocols.

## Practical-4 ( HC )
## Cryopreservation Techniques

- Introduction to Cryopreservation in IVF

- Overview of the role of cryopreservation in assisted reproductive technology (ART).

- Cryobiology Principles

- Effects of low temperatures on cellular structures and functions.
- Types of Cryopreservation

- Slow Freezing: Traditional method for cryopreserving embryos and oocytes.
- Vitrification: Modern technique for rapid freezing without ice formation.
- Cryoprotectants

- Types of cryoprotectants
- Mechanisms of action and toxicity considerations.
- Cryopreservation of Sperm

- Protocols for freezing and thawing human sperm.
- Quality assessment post-thaw and its implications for fertilization.
- Oocyte Cryopreservation

- Techniques for freezing and thawing mature oocytes.
- Challenges and success rates associated with oocyte cryopreservation.
- Embryo Cryopreservation

- Day 3 vs. Blastocyst Freezing: Choosing the optimal stage for embryo cryopreservation.
- Post-thaw survival and implantation rates.
- Ovarian Tissue Cryopreservation

- Indications and techniques for preserving ovarian tissue.
- Applications in fertility preservation for cancer patients.
- Cryopreservation of Testicular Tissue

- Techniques for freezing and thawing testicular tissue, especially in cases of azoospermia.
- Use in pediatric oncology and future fertility preservation.
- Vitrification Protocols

- Step-by-step protocols for vitrification of oocytes and embryos.
- Equipment and materials required for successful vitrification.
- 11. Thawing Techniques

- Detailed protocols for thawing vitrified oocytes, embryos, and tissues.

- Common issues during thawing and how to address them.
- Quality Control in Cryopreservation

- Monitoring and maintaining cryopreservation equipment (e.g., liquid nitrogen tanks).
- Documentation and tracking of cryopreserved samples.

## Semester - III

### Paper-1

### Assisted Reproductive Techniques & Emerging Technologies in ART (HC)

**32 Hours**

### Unit-1

- Advances in In Vitro Fertilisation (IVF)
    - Time-lapse imaging and embryo selection
    - Blastocyst culture and transfer
    - Optimising ovarian stimulation protocols
- Cryopreservation Techniques
    - Cryopreservation of ovarian tissue
    - Advances in sperm freezing and thawing-sperm vitrification
    - Cryopreservation of testicular tissue
    - Innovations in cryoprotectant solutions

### Unit-2

- Genetic Screening and Diagnosis
    - Non-invasive preimplantation genetic testing (NiPGT)
    - Next-generation sequencing (NGS) in PGT
    - Comprehensive chromosome screening (CCS)
    - Single-cell genomics and transcriptomics

- Gamete Manipulation and Micro manipulation Techniques
    - Intracytoplasmic sperm injection (ICSI) advancements
    - Robotic ICSI
    - Oocyte activation techniques
    - Sperm selection methods (e.g., MACS, IMSI, PICSI )
    - Assisted hatching techniques

### Unit-3

- Artificial Intelligence and Machine Learning in ART
    - AI-based embryo selection
    - Predictive analytics in IVF outcomes
    - Automation in laboratory processes
    - Big data and its implications for ART
- Stem Cell Research and Applications
    - Derivation of gametes from stem cells

- Stem cell-based therapies for infertility
- Ethical considerations in stem cell use
- Regenerative medicine in reproductive health

- Uterine and Endometrial Advances
    - Uterine transplantation
    - Advances in endometrial receptivity testing
    - Novel approaches to improve implantation rates
    - Treatment of Asherman's syndrome and other uterine abnormalities

## Unit-4

- Fertility Preservation
    - Fertility preservation in cancer patients
    - Ovarian tissue transplantation
    - Novel techniques in oocyte and embryo freezing
    - Fertility preservation in transgender individuals
- Emerging Technologies in ART
    - 3D printing in reproductive medicine
    - Organoids and their application in reproductive research
    - Nanotechnology in gamete and embryo handling
    - Wearable technology for fertility monitoring
- Regulatory and Ethical Aspects of Newer ART Advances
    - Ethical implications of gene editing in embryos
    - Legal considerations in emerging ART technologies
    - International regulations on ART practices
    - Patient consent and counselling for advanced ART procedures

Paper-2

# Genetics in Reproduction ( HC)

**32 Hours**

## Unit-1

**Basic genetics & Gene regulation:**

- Translation, transcription,
- expression,
- imprinting
- genotype, phenotype,
- mandalian inheritance,
- chromosomal abnormalities,
- Epigenetic
- human reproductive genetics
- Genetic basis of infertility,
- genetic counselling in reproductive health,
- inherited genetic disorders
- genetic factors in recurrent pregnancy loss.
- Basic Genetics

## Unit-2

- Mendelian Inheritance: Principles of dominant and recessive traits, and patterns of inheritance.
- Chromosomal Structure and Function: Organization, types, and roles of chromosomes in heredity.
- DNA Replication: Mechanisms of DNA synthesis and the enzymes involved.
- Genetic Mutations: Types of mutations, their causes, and effects on gene function.
- Genetic Linkage and Mapping: Understanding gene linkage, recombination, and chromosomal mapping.
- Epigenetics: Mechanisms of epigenetic regulation, including DNA methylation and histone modification.
- Genetic Disorders: Overview of monogenic and polygenic disorders, including their inheritance patterns.
- Gene Regulation:
- Transcriptional Regulation: Role of promoters, enhancers, transcription factors, and RNA polymerase.
- Post-Transcriptional Regulation: Mechanisms such as RNA splicing, editing, and degradation.
- Translational Regulation: Control of mRNA translation into proteins, including ribosome activity and initiation factors.
- Gene Silencing: Mechanisms of RNA interference (RNAi) and microRNA (miRNA) in gene expression regulation.
- Signal Transduction Pathways: How external signals influence gene expression through intracellular signaling cascades.
- Chromatin Remodeling: The role of chromatin structure in regulating gene access and expression

## Unit-3

- Molecular techniques in reproductive genetics:
- Polymerase Chain Reaction (PCR): Amplification of DNA sequences for genetic analysis, including applications in reproductive genetics.
- Next-Generation Sequencing (NGS): High-throughput sequencing techniques for analyzing genetic variations and mutations related to fertility.
- Preimplantation Genetic Testing (PGT): Techniques used to screen embryos for genetic abnormalities before implantation.
- Fluorescence In Situ Hybridization (FISH): Chromosome analysis in embryos and gametes to detect aneuploidies and structural rearrangements.
- Comparative Genomic Hybridization (CGH): A technique to detect chromosomal imbalances in embryos or fetuses.
- Quantitative PCR (qPCR): Real-time PCR for quantifying gene expression levels and detecting genetic mutations in reproductive cells.

## Unit-4

- Single Nucleotide Polymorphism (SNP) Genotyping: Analysis of genetic variations associated with reproductive traits and disorders.
- CRISPR-Cas9 Gene Editing: Techniques for modifying genes in reproductive cells to study gene function or correct mutations.
- Southern Blotting: DNA analysis technique for detecting specific genetic sequences related to reproductive health.

- Methylation-Specific PCR (MSP): Assessing DNA methylation patterns in genes involved in reproductive processes and disorders
- genomic editing techniques-CRISR-Cas9
- pre-implantation genetic testing:
- Indication and methods of PGT, non-invasive PGT, ethical considerations in PGT, clinical applications, embryo biopsy techniques.

## Practical- 5 ( HC )
## Advanced ART laboratory procedures

- Advanced ICSI Techniques

- Advanced Micro manipulation Techniques: Hands-on training with various micro manipulation systems.
- ICSI with Immature Oocytes: Maturation and microinjection techniques for immature oocytes.
- ICSI with Azoospermic Samples: Handling and microinjection of sperm extracted through TESE/ PESA.
- IMSI Techniques
- PICSI Techniques
- Time-Lapse Imaging in Embryology
- Setting Up Time-Lapse Systems: Installation and calibration of time-lapse imaging systems.
- Embryo Monitoring and Analysis: Continuous monitoring and assessment of embryo development using time-lapse imaging.
- Embryo Culture Techniques

- Extended Culture to Blastocyst Stage: Techniques for culturing embryos to the blastocyst stage.
- Co-Culture Techniques: Culturing embryos with feeder cells or using alternative media.
- Micro manipulation Skills

- Quality Control in ART Labs

- Validation of Equipment and Procedures: Implementing and documenting validation protocols.
- Environmental Monitoring and Air Quality Control: Hands-on experience with monitoring systems.
- Artificial Intelligence in Embryo Selection

- Integration of AI in Embryo Scoring: Use of AI tools for embryo assessment and selection.
- Validation of AI Systems: Practical aspects of validating AI-based embryo scoring systems.

## Practical-6
## Embryo Biopsy Techniques ( HC )

- **Embryo Biopsy Techniques**

- Assisted Hatching Techniques

- Laser-Assisted Hatching: Practical use of laser technology for assisted hatching.
- Chemical and Mechanical Assisted Hatching: Different approaches to assisted hatching.

- Different embryo biopsy techniques, laser assisted hatching, basics of laser machine, non invasive PGT.
- Standard operating protocols for IVF lab procedures.
- advanced Art lab procedures, need list of practicals for above topic in embryology for masters program
- Equipment Familiarisation
    - Introduction to laser equipment
    - Hands-on familiarisation with micro manipulation / laser equipment.
- Cleavage Stage Embryo Biopsy (Blastomere Biopsy)
    - Preparation of biopsy dishes and tools.
    - Performing blastomere biopsy on simulated embryos.
    - Practicing blastomere biopsy on actual embryos.
- Blastocyst Stage Biopsy (Trophectoderm Biopsy)
    - Laser-assisted hatching techniques.
    - Performing trophectoderm biopsy on simulated embryos.
    - Practicing trophectoderm biopsy on actual blastocysts.
- Laser assisted hatching
    - Precision handling of biopsy tools.
    - Isolating blastomeres and trophectoderm cells using micro manipulators.
    - Troubleshooting common issues during micro manipulation.
- Post-Biopsy Embryo Handling
    - Culturing biopsied embryos.
    - Sample preparation for genetic analysis.
    - Monitoring embryo development post-biopsy.
- Quality Control in Embryo Biopsy
    - Implementing quality control measures.
    - Ensuring accuracy in biopsy procedures.
    - Analysing case studies for troubleshooting.
- Comprehensive Embryo Biopsy Simulation
    - Conducting an embryo biopsy from start to finish.
    - Managing post-biopsy embryo care.
    - Preparing and presenting a lab report.
- Basics of creating standard operating protocols.

Paper-3

## Regenerative Medicine in Reproduction & scientific writing (SC)

**32 Hours**

### Unit- 1

- Introduction to Regenerative Medicine

- Overview of Regenerative Medicine:
  - Definition and scope of regenerative medicine
  - Historical development and key milestones
  - Key concepts: cell therapy, tissue engineering, and regenerative biology
- Regenerative Medicine in Reproductive Health:
  - Application of regenerative medicine in treating reproductive disorders
  - Potential and challenges in integrating regenerative medicine with ART
  - Emerging trends in reproductive regenerative therapies
- Stem Cells in Reproductive Medicine

- Types of Stem Cells:
  - Embryonic stem cells, adult stem cells, and induced pluripotent stem cells (iPSCs)
  - Characteristics and differentiation potential of stem cells
  - Stem cell niches and their role in reproduction
- Stem Cell Applications in Infertility:
  - Use of stem cells in treating male and female infertility
  - Germ cell differentiation from stem cells
  - Ovarian and testicular regeneration using stem cells
- Clinical Applications:
  - Stem cell-based therapies for Asherman's syndrome, endometrial regeneration, and ovarian failure
  - Current research and future directions
  - Case studies and clinical trials
- Tissue Engineering in Reproductive Medicine

- Basics of Tissue Engineering:
  - Key components: scaffolds, cells, and growth factors
  - Techniques in tissue engineering: 3D printing, bioreactors, and scaffold design
  - Challenges in tissue engineering for reproductive tissues
- Engineering Reproductive Tissues:
  - Uterine tissue engineering: creating functional endometrium
  - Engineering fallopian tubes and ovaries: current research and prospects
  - Testicular tissue engineering: potential applications in male infertility treatment

### Unit- 2

- Organ Bioengineering:
  - Uterine transplants and bioengineered organs

- Creating artificial gametes and reproductive organs
- Ethical considerations in reproductive tissue engineering

- Cellular Therapies in Reproductive Medicine

- Cellular Therapies Overview:
  - Types of cellular therapies: autologous vs. allogeneic
  - Role of cellular therapies in regenerating reproductive organs
  - Advances in cell-based treatments for infertility
- Endometrial and Ovarian Regeneration:
  - Use of mesenchymal stem cells (MSCs) for endometrial regeneration
  - Ovarian rejuvenation using platelet-rich plasma (PRP) and stem cells
  - Clinical outcomes and challenges in cell therapy
- Spermatogonial Stem Cells (SSCs):
  - Role of SSCs in male fertility restoration
  - Transplantation techniques and applications in azoospermia
  - Current research and therapeutic potential
- Ethical Issues in Regenerative Medicine:
  - Ethical challenges in using embryonic stem cells
  - Considerations for clinical trials and patient consent
  - The debate over creating artificial gametes and organs
- Regulatory Landscape:
  - International regulations on regenerative medicine in reproductive health
  - Legal aspects of stem cell research and therapy in reproduction
  - Case studies on regulatory challenges and breakthroughs
- Social and Ethical Implications:
  - Public perception of regenerative technologies in reproduction
  - The potential impact on future reproductive practices
  - Addressing social concerns and ethical dilemmas
- Future Perspectives in Reproductive Regenerative Medicine

- Emerging Technologies:
  - Advances in CRISPR and gene editing for regenerative applications
  - Organoids and their role in reproductive medicine
  - Nanotechnology in regenerative medicine
- Translational Research:
  - From bench to bedside: Translating regenerative research into clinical practice
  - Challenges in commercialising regenerative therapies
  - Future prospects and potential breakthroughs
- Global Impact:
  - The role of regenerative medicine in addressing global reproductive health issues
  - Collaborative efforts in research and clinical application
  - Predictions for the future of reproductive regenerative medicine

## Unit-3

- Foundations of Scientific Communication

- Principles of Effective Communication:
  - Importance of clarity, conciseness, and coherence in scientific writing

- Understanding the audience: tailoring communication to different readers
- Structure and organisation of scientific documents

- Types of Scientific Communication:
  - Research articles: original research, reviews, case studies
  - Conference presentations: oral presentations, posters
  - Grant writing: proposals for research funding
  - Patient communication: educational materials and consent forms
- Writing Research Papers in Embryology

- Components of a Research Paper:
  - Title, abstract, introduction, methods, results, discussion, and references
  - Developing a strong thesis and research question
  - Presenting data effectively through tables, figures, and legends
- The Writing Process:
  - Drafting and revising: strategies for improving clarity and impact
  - Common pitfalls in scientific writing and how to avoid them
  - Writing with accuracy: reporting results and avoiding bias
- Citing Sources and Avoiding Plagiarism:
  - Importance of proper citation and referencing
  - Using citation management tools (e.g., EndNote, Mendeley)
  - Understanding plagiarism: types, consequences, and prevention
- Writing for Grants and Proposals

- Understanding Grant Proposals:
  - Key elements: specific aims, background, significance, methodology, budget
  - Identifying and targeting funding opportunities in reproductive research
  - Writing a compelling proposal: aligning objectives with funding priorities
- Budgeting and Project Planning:
  - Developing a realistic and detailed budget
  - Planning project timelines and milestones
  - Writing a project management plan
- Review Process:
  - Understanding the peer-review process for grant proposals
  - Responding to reviewers' comments and revising proposals
  - Strategies for resubmission after rejection

## Unit-4

- Oral and Visual Communication

- Oral Presentations:
  - Preparing and delivering effective scientific presentations
  - Structuring talks: introduction, body, conclusion, and Q&A
  - Techniques for engaging and maintaining audience interest
- Poster Presentations:
  - Designing and organising an academic poster

- Visualising data: selecting charts, graphs, and images
- Presenting a poster at conferences: best practices and common challenges

- Communication with Non-Scientists:
  - Simplifying complex scientific concepts for the general public
  - Writing patient information leaflets and educational brochures
  - Communicating ethical and sensitive topics in reproductive medicine
- Writing for Academic and Professional Audiences

- Review Articles and Book Chapters:
  - Writing comprehensive and balanced reviews in embryology
  - Synthesising literature and presenting an authoritative overview
  - Writing book chapters: organisation, depth, and scholarly contribution
- Case Reports and Clinical Summaries:
  - Structuring and writing case reports in reproductive medicine
  - Documenting clinical observations and outcomes
  - Ethical considerations in writing case reports
- Professional Correspondence:
  - Writing letters to editors, responses to reviewers, and professional emails
  - Crafting CVs, cover letters, and personal statements for academic applications
  - Writing reports and memos in a clinical or laboratory setting

- Ethics and Integrity in Scientific Writing

- Scientific Integrity:
  - Principles of honesty, transparency, and reproducibility in research
  - Recognising and addressing conflicts of interest
  - Ethical considerations in authorship and peer review
- Ethics in Communication:
  - Ethical challenges in communicating controversial topics in embryology
  - Balancing accuracy and compassion in patient communication
  - Ethical considerations in public engagement and media interactions

- Clinical outcomes and ethical considerations

## Semester - 4

## Research Project Work / Dissertation ( HC )

Project work in ART Level-2 centres / Research centres to understand and do the research independently. Statistical evaluation of the project/ research work & presentation as dissertation to the teaching institute.

## Scientific writing and presentation skills:

Students have to select a journal article from recent SCOPUS index journal in the field of Embryology/ reproductive medicine, critically evaluate the journal article and make a presentation. This will be evaluated as internal assessment. There will not be any C3 component.

Reference Books:

| SR. | TEXT BOOK NAME | AUTHOR NAME |
|---|---|---|
| 1 | "In Vitro Fertilization: The A.R.T. of Making | Geoffrey Sher, Virginia |
| 2 | "Textbook of Assisted Reproductive Techniques: Laboratory and Clinical Perspectives" | David K. Gardner, Ariel Weissman, Colin M. |
| 3 | "Embryology: An Illustrated Colour Text" | Barry Mitchell, Ram |
| 4 | "IVF in the Medically Complicated Patient: A | R. Scott Lucidi, William |
| 5 | "Human Embryology and Developmental | Bruce M. Carlson |
| 6 | "Principles and Practice of Assisted Reproductive | Kamini A. Rao |
| 7 | "In Vitro Fertilization: A Practical Approach" | David K. Gardner, |
| 8 | "Clinical In Vitro Fertilization" | Kay Elder, Brian Dale |
| 9 | "Atlas of Human Gametes and Conceptuses: An Illustrated Reference for Assisted Reproductive | E. Scott Sills, G. David Ball |
| 10 | "Embryos, Genes and Birth Defects" | Patrizio, M., & Sermon, |
| 11 | "Embryo Culture: Methods and Protocols" | Kim, B. H., & van den |
| 12 | "Human Fertilisation and Early Embryology | HFEA |
| 13 | "In Vitro Fertilization and Embryo Transfer: A | Kay Elder, Brian Dale |
| 14 | "Handbook of In Vitro Fertilization" | David K. Gardner, Ariel |
| 15 | "Reproductive Endocrinology and Infertility: The Requisites in Obstetrics and Gynecology" | Richard S. Legro, Marc A. Fritz |
| 16 | "Human Embryonic Stem Cell Protocols" | Kursad Turksen (Editor) |
| 17 | "A Color Atlas for Human Assisted Reproduction: Laboratory and Clinical Insights" | Antonis Makrigiannakis |
| 18 | "Embryology: An Illustrated Colour Text" | Barry Mitchell, Ram |
| 19 | "Principles and Practice of Oocyte Preservation | Eleonora Porcu, Patrizia |
| 20 | "In Vitro Fertilization: A Comprehensive Guide" | Jan Tesarik |
| 21 | "Practical Manual of In Vitro Fertilization: Advanced Methods and Novel Devices" | Zsolt Peter Nagy |
| 22 | "Embryology: An Illustrated Colour Text" | Barry Mitchell, Ram |
| 23 | "Principles and Practice of Fertility Preservation" | Jacques Donnez, S. |
| 24 | "Embryo Culture: Methods and Protocols" | Kim, B. H., & van den |

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| 25 | "Human Fertilisation and Early Embryology | HFEA |
| 26 | "Clinical Embryology: A Practical Guide" | David K. Gardner, |
| 27 | "Vitrification in Assisted Reproduction: A User's Manual and Trouble-Shooting Guide" | David K. Gardner |
| 28 | "Human Embryonic Stem Cells: The Practical | Stephen Sullivan, Mark |
| 29 | "In Vitro Maturation of Human Oocytes: Basic Science to Clinical Application" | Ri-Cheng Chian |
| 30 | "Assisted Reproductive Technologies Quality and | David K. Gardner, Luca |
| 31 | "Embryos in Deep Time: The Rock Record of | Marcelo R. Sánchez- |
| 32 | "Clinical Reproductive Medicine and Surgery" | Tommaso Falcone, |
| 33 | "In Vitro Fertilization: A Textbook of Current and | Kevin D. Dorfmann |
| 34 | "Handbook of in Vitro Fertilization, Fourth | David K. Gardner, Colin |
| 35 | "Clinical Embryology: A Color Atlas and Text" | David K. Gardner, |
| 36 | "In Vitro Fertilization and Embryo Transfer: A | Kay Elder, Brian Dale |
| 37 | "Stem Cells: A Very Short Introduction" | Jonathan Slack |
| 38 | "In Vitro Fertilization: A Practical Approach" | Kay Elder, Brian Dale |
| 39 | "The Ovary" | Peter M. Doubilet, Carol |
| 40 | "Embryonic Stem Cells: Methods and Protocols" | Kursad Turksen (Editor) |
| 41 | "Handbook of In Vitro Fertilization, Second | David K. Gardner, Colin |
| 42 | "Clinical Embryology: A Color Atlas and Text" | David K. Gardner, |
| 43 | "In Vitro Fertilization and Embryo Transfer: A | Kay Elder, Brian Dale |
| 44 | "Stem Cells: A Very Short Introduction" | Jonathan Slack |
| 45 | "Human Embryonic Stem Cells: The Practical | Stephen Sullivan, Mark |
| 46 | "In Vitro Maturation of Human Oocytes: Basic Science to Clinical Application" | Ri-Cheng Chian |
| 47 | "Embryos in Deep Time: The Rock Record of | Marcelo R. Sánchez- |
| 48 | "Clinical Reproductive Medicine and Surgery" | Tommaso Falcone, |
| 49 | "In Vitro Fertilization: A Textbook of Current and | Kevin D. Dorfmann |
| 50 | "Handbook of in Vitro Fertilization, Fourth | David K. Gardner, Colin |

## Scheme of Examination

**Theory examination:**

Total marks : 70 marks

Question paper will have 2 parts.

Part-1 comprises of short questions 10 numbers, out of which 7 are compulsory ( 2 x 7=14)

Part-2 comprises of long questions 10 numbers, out of which 8 questions are compulsory ( 7 x 8=56)

**Practical examination:**

Total marks 70.

Distribution of marks:

Major experiment : 30 marks

Minor experiment + spotters : 20 marks

Vivavoce: 10 marks

Practical record : 10 marks

**Semester IV** : Total marks 70

Project work report : 40 marks

Vivavoce: 30 marks

Journal presentation in semester IV will be evaluated as internal assessment (No C3 component).