

Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Embryology	Type: Theory + Practicals
Subject: DSC-3 Assisted Reproductive Technology (ART) -1	Semester: 2
Credit: 04 + 02	Total Learning Hours: 60 h + 60 h
Course Description: The course is designed to introduce students to the set up of the Assisted Reproductive Technology Centers, the basic requirements for establishing the center, the documentation and management systems for smooth functioning and database maintenance at the center. The course also deals with the basic techniques for handling animal cells in in vitro conditions.	
Student Learning Outcome: After completion of this course student will be able to: <ol style="list-style-type: none"> 1. Understand the need and criteria for the ART-IVF center set up. 2. Apply knowledge of animal cell handling and aseptic technique for embryo culture. 3. Learn significance and importance of documentation and data management at the center. 	

Unit -Introduction to IVF Laboratory (5 hours)

- 1.1 Pioneers and Development of Cell Culture Techniques
- 1.2 Introduction to IVF laboratory and Emergence of IVF Industry
- 1.3 Techniques for Assisted Reproduction
- 1.4 Regulatory Development in IVF

Unit 2 Establishment of ART Clinic (5 hours)

- 2.1 Location
- 2.2 Basic Infrastructure and Floor Plan
- 2.3 Construction
- 2.4 Dos & Don't of IVF lab

Unit 3 Requirements of ART Laboratory (8 hours)

- 3.1 The Laboratory Personnel
- 3.2 Equipments for sterile area
- 3.3 Equipments for non sterile area
- 3.4 Specialized Instruments

Unit-4 IVF culture systems and overview (9 Hours)

- 4.1 Workstation
- 4.2 Preparation of media and reagents
- 4.3 Consumables
- 4.4 Labwares

Unit-5 Air quality control in reproductive labs (7 Hours)

- 5.1 Control of Particles and VOC
- 5.2 Construction details for Air quality control and Air Quality Monitoring
- 5.3 Air Handling Ventilation Unit Room
- 5.4 Air quality control in Embryology laboratory, Operating Room and Embryo Transfer Room

Unit-6 Basic cell culture techniques (9 Hours)

- 6.1 Basic rules for Cell Culture Laboratory

- 6.2 Aseptic Technique and sterile handling
- 6.3 Cell separation techniques
- 6.4 Maintenance of Cells in Laboratory

Unit-7 Laboratory information and document management system (9 Hours)

- 7.1 Need for management of laboratory information and documents
- 7.2 Collection and Storage of Data of Patients and ART treatments
- 7.3 Modules of a Fertility Clinic Management Database (e.g. ARTIS and PALASH)
- 7.4 Document Management in IVF laboratory

Unit-8 QC and risk management of ART center (8 Hours)

- 8.1 Introduction to Quality Control & Assurance
- 8.2 Quality Audit & internal quality control
- 8.3 Quality Management System
- 8.4 Risk Management at ART Center

References:

1. Textbook Of Assisted Reproductive Techniques Volume 1: Lab Perspectives By David Gardner, Areil Weissman, Colin M Howles, Zeev Shoham, CRC Press, 5th Edition
2. Varghese, Alex C., Peter Sjoblom, and K. Jayaprakasan. A Practical Guide To Setting Up An Ivf Lab, Embryo Culture Systems And Running The Unit. JP Medical Ltd, 2013.
3. Ian R. Freshney, Culture Of Animal Cells: A Manual Of Basic Technique And Specialized Applications, 6th Ed., Willey Blackwell pub.

Practicals:

- 1) To perform mononuclear cell separation by density gradient centrifugation.
- 2) To study maintenance of animal cell lines in an animal cell culture laboratory.
- 3) A Visit to IVF Center.

Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Biotechnology	Type: Theory + Practicals
Subject: DSC-4 Endocrinology & Developmental Biology	Semester: 2
Credit: 04 + 02	Total Learning Hours: 60 h + 60 h
Course Description: This Course will make students ready with all relevant background to deal with Hormones & developing Oocyte- embryo. It will provide fundamental knowledge about key aspects of the neuroendocrine system & developmental stages of a human foetus.	
Student Learning Outcome: After completion of this course student will be <ul style="list-style-type: none"> • well informed about basic concepts of endocrine glands, hormones, stem cells , & development of foetus • will acquire knowledge about different disorders as well 	

Unit -1 Introduction to Neuro-Endocrinology (06 hours)

- 1.1 Endocrine Glands & their secretions
- 1.2 Hypothalamus Pituitary Axis
- 1.3 Mechanism of Hormone Action
- 1.4 Control of Hormone Secretion

Unit 2 Hormones (08 Hours)

- 2.1 Hormones of Pituitary Gland
- 2.2 Hormones of Thyroid Gland
- 2.3 Testosterone & other Male Hormones
- 2.4 Female Hormonal System
- 2.5 AMH & Placental hormones

Unit 3 Endocrine Disorders (06 Hours)

- 3.1 Hyper & Hypothyroidism
- 3.2 Premature Ovarian Insufficiency (POI)
- 3.3 Andropause

Unit-4 Preimplantation Embryonic Development (09 Hours)

- 4.1 Genome Activation
- 4.2 Developmental Stages (Cleavage till Blastomere)
- 4.3 Causes of Early Embryo Arrest
- 4.4. Metabolic Requirements of Embryo

Unit-5 Developmental Biology (09 Hours)

- 5.1 Embryonic Stem cells & Early Embryogenesis
- 5.2 Primordial Germ Cell Migration
- 5.3 Foetal Ovary & Foetal Testis
- 5.4 Embryonic Induction & Competence, Differentiation

Unit-6 Embryonic development of Human - 1 (09 Hours)

- 6.1 Maternal Changes during Pregnancy
- 6.2 First Week Development
- 6.3 Second Week Development

Unit-7 Embryonic development of Human - 2 (07 Hours)

- 7.1 Third Week Development
- 7.2 Fourth Week Development
- 7.3 Fifth to Eight Week Development
- 7.4 Fetal Period

Unit-8 Pregnancy Disorders (04 Hours)

- 8.1 Implantation failures
- 8.2 Extra Uterine Pregnancies
- 8.3 Spontaneous Abortions & Miscarriages
- 8.4 Antenatal Anomalies of Babies

References:

1. Principles of Anatomy & Physiology by Gerard J Tortora & Bryan H Derrickson, Wiley Pub.
2. Text Book of Medical Physiology by Guyton & Hall, Elsevier
3. Text Book of Gynaecology by D C Dutta

Practicals:

- 1) To study the structure of glands with the help of permanent slides.
- 2) To study different ELISA methods to detect hormones
- 3) To study hCG hormone detection test.
- 4) To study fetus development stages by different charts.
- 5) Visit to a Pathological Lab.

Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Embryology	Type: Theory + Practical
Subject: SEC-2 Genetics and Preimplantation Genetic Diagnosis (PGD)	Semester: 2
Credit: 04 + 02	Total Learning Hours: 60 + 60
Course Description: The course aims at catering the knowledge about basic Genetics and genetic basis of certain developmental defects and genetic disorders. The course specifically covers the genetic correlation with infertility disorders in male as well as female. The other part of the course deals with the importance and technicality of Preimplantation Genetic diagnosis of embryo before implantation into the uterus. It encompasses the application of PGD in screening in case of patients with recurrent IVF failures or recurrent pregnancy losses. It also elaborates on principles and working of the micromanipulator which plays as the heart of the IVF center.	
Student Learning Outcome: After completion of this course student will be able to: <ol style="list-style-type: none"> 1. Correlate genetic causes and basis for infertility related genetic disorders. 2. Apply the techniques to assess the embryo feasibility and normalcy before implanting into the patient. 3. Learn about operating the micromanipulator. 	

Unit -1 Introduction to Genetics (9 hours)

- 1.1 Classical Mendelian Genetics
- 1.2 Modern Genetics (Extensions of and Deviations from Mendelian Genetic Principles)
- 1.3 Immunogenetics
- 1.4 Mitochondrial Inheritance

Unit 2 Developmental Malformations and Birth defects (8 hours)

- 2.1 Developmental Biology and Birth Defects
- 2.2 Environmental Influence on Human Malformations
- 2.3 Genetic Causes of Human Malformations
- 2.4 Mitochondrial mutations

Unit 3 Mutations and Genetic disorders (8 hours)

- 3.1 Structural Chromosomal mutations
- 3.2 Variation in Chromosomal numbers
- 3.3 Types of Genetic Disorders
- 3.4 Recurrent Pregnancy loss due to genetic anomalies

Unit-4 Infertility Genetic Disorders (10 Hours)

- 4.1. Autosomal (Recessive & Dominant) Disorder
- 4.2 X chromosome abnormalities and female infertility (X-Linked Disorder)
- 4.3 Y chromosome disorder-Swyer syndrome
- 4.4 Ovarian failure disorders
- 4.5 Chromosomal anomalies and male infertility
- 4.6 Syndromic monogenic defects in male infertility

Unit-5 Epigenetics associated with ART (8 Hours)

- 5.1 Epigenetic marks and Genomic imprinting
- 5.2 Epigenetic reprogramming in germline

- 5.3 Imprint maintenance during preimplantation development
- 5.4 Epidemiological data in ART
- 5.5 ART induced epigenetic changes

Unit 6 Introduction to PGD (5 Hours)

- 6.1 PGD- Historical perspectives
- 6.2 Indications for PGD
- 6.3 Steps for PGD
- 6.4 Challenges with PGD

Unit-7 PGD for Screening (4 Hours)

- 7.1 Evolution of PGD for chromosomal anomalies screening
- 7.2 PGD for Monogenic Disorders
- 7.3 PGD for HLA matching
- 7.4 PGD for cancer predisposition

Unit-8 Techniques for PGD (8 Hours)

- 8.1. Embryo Biopsy (Polar body, Blastomere & Trophectoderm Biopsy)
- 8.2 Karyotyping
- 8.3 Advanced PCR techniques
- 8.4 Hybridization techniques: FISH (Fluorescence In situ Hybridization) and CGH (Comparative Genomic Hybridization)
- 8.5 NGS (Next Generation Sequencing)

References:

1. Textbook of Assisted Reproductive Techniques Volume 1: Lab Perspectives by David Gardner, Areil Weissman, Colin M Howles, Zeev Shoham, CRC Press, 5th Edition
2. Pankaj Talwar, and Kuldeep Jain. "IVF Techniques for the Beginners." (2013): 70-70.
3. Rimoin D., Connor J. M, Pyeritz R., Korf B., (2002) Emery and Rimoin's Principles and Practice of Medical Genetics, Fourth Edition, Churchill Livingstone (Elsevier Science Ltd.) ISBN: 9780443064340
4. Gardner A. and Davies T., (2012), Human Genetics Second Edition. Scion Publishing Ltd. ISBN:978-81-309-1364-3
5. Klug, W. S. and Cummings, M. R. (2007) *Concepts of Genetics*, 7th Edition, Pearson Education. ISBN 13: 978-0-321-79578-6
6. Russell, P. J, (2010) *iGenetics*, 3rd edition, Pearson Education ISBN-9789332571624
7. In Vitro Fertilization by Kay Elder & Brian Dale- 3rd Ed. , Cambridge University Press

Practicals:

- 1) To study Karyotyping of metaphase plate photographs.
- 2) To perform PCR and study the principle of PCR.
- 3) Demonstration of working of Micromanipulator.
- 4) A visit to the Genetic Diagnostic Laboratory.