

SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE



SARVAJANIK
UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

Department of Biotechnology
M.Sc. Clinical Embryology
in collaboration with
BLISS IVF - Fertility & Andrology
Institute, Surat

SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE



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UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

Faculty of Science
M. Sc. (Clinical Embryology)
SEM 1 and 2
DETAILED CURRICULUM
(W.E.F. 2025-26)

SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE

Semester 1

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	1		Version	2		
Semester	1		Effective From	July 2025		
Course Code	MSBT21101	Course Name	Cell Biology and Molecular Techniques with Proteomics and Metabolomics			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
4	4	0	0	70	30	100



Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Embryology	Type: Theory + Practical
Subject: DSC-1 Cell Biology and Molecular Techniques With Proteomics and Metabolomics	Semester: 1
Credit: 04 + 02	Total Learning Hours: 60 h + 60 h
Course Description: The aim of this paper is to provide basic information on cell, cellular interactions and processes along with insight in basic biochemical metabolisms with respect to embryo development, various biophysical techniques relevant to studying metabolomics and proteomics of human embryo development.	
Student Learning Outcome: After completion of this course student will be able to: <ol style="list-style-type: none"> 1. Understand the basic properties and functions of cell and their interactions 2. Link major signalling pathways with in vitro embryo development 3. Apply biophysical techniques in analysis and assessment for IVF samples. 4. Learn the metabolomics and proteomics of embryo development for non invasive embryo assessment technique development. 	

Unit -1 Basic Cell Biology (8 hours)

- 1.1 Basic properties of cell
- 1.2 Structure and function of cell membrane
- 1.3 Structure and function of cell organelles (with respect to Oocyte)
- 1.4 Cellular interactions

Unit 2 Cell division (6 hours)

- 2.1 Cell Cycle
- 2.2 Mitosis
- 2.3 Meiosis (Principles and Errors in Meiosis)

Unit 3 Cellular Processes and Signaling Pathways (9 hours)

- 3.1 Basics of elements of cell signaling
- 3.2 Extracellular messengers and their receptors
- 3.3 Types of signal transducers
- 3.4 JAK/STAT Pathway, Hedgehog, Wnt and Notch pathways

Unit-4 Biochemical Cellular Processes (8 Hours)

- 4.1 Glucose metabolism
- 4.2 Oxidative phosphorylation
- 4.3 Fatty acid metabolism
- 4.4 Amino acid metabolism
- 4.5 Biochemical roles of fat soluble Vitamins and water soluble vitamins
- 4.6 Reactive Oxygen Species and protection mechanisms of oocytes and embryos from ROS

Unit-5 Molecular Biology of Oocyte (7 Hours)

- 5.1 Structure of Nucleic acid (DNA, RNA)
- 5.2 Nucleosome structure
- 5.3 Replication
- 5.4 Transcription
- 5.5 Translation



Unit-6 Molecular Techniques (8 Hours)

6.1 2D PAGE

6.2 MS (LC-MS, GC-MS, HPLC-MS, UPLC-MS, CE-MS)

6.3 SELDI-TOF and MALDI-TOF

6.4 Protein microarray

6.5 NMR

6.6 FTIR

Unit-7 Proteomics (7 Hours)

7.1 Principles of Proteomics

7.2 Potential Protein biomarkers

7.3 Embryonic proteome

7.4 Embryonic Secretome

Unit-8 Metabolomics (7 Hours)

8.1 Principles of metabolomics

8.2 Potential metabolic biomarkers

8.3 Sample Types and collection

8.4 Metabolomics of the embryo

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 ISBN 13: 978-1-4987-4014-2
2. In Vitro Fertilization by Kay Elder & Brian Dale- 3rd Ed. , Cambridge University Press
3. Karp, G. (2016). *Cell and Molecular Biology: Concepts And Experiments*. John Wiley & Sons, ISBN-978-1-118-88614-4
4. Cooper, G. M., & Hausman, R. E. (2004). *The Cell: A Molecular Approach* .ISBN-0878932143
5. Rapley, Ralph, and John M. Walker, eds. *Molecular Biomethods Handbook*. No. 1646. Springer Science & Business Media, 1998. ISBN: 978-1-60327-374-9
6. Primrose S & Twyman R, *Principles of Gene Manipulation and Genomics*, 7th ed, Blackwell, 2006 6. ISBN 978-1405135443

Practicals:

- 1) Study of permanent slides of stages of mitosis and meiosis.
- 2) Estimation of glucose from a given sample by GOD method .
- 3) To perform protein analysis through SDS PAGE
- 4) Visit to the Analytical Laboratory for demonstration of Biophysical techniques



Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	I		Effective From	July 2025		
Course Code	MSBT21102	Course Name	Human Reproductive Biology			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
4	4	0	0	70	30	100



Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Biotechnology	Type: Theory + Practical
Subject: DSC- 2 Human Reproductive Biology	Semester: 1
Credit: 04 + 02	Total Learning Hours: 60 h + 60 h
Course Description: This Course will make students ready with all relevant backgrounds of human reproductive biology. It will provide fundamental knowledge about key concepts & anatomy of organs of reproduction.	
Student Learning Outcome: After completion of this course student will be ...	
<ul style="list-style-type: none"> ● well informed about female & male reproductive anatomy, histology ● will be able to understand basic concepts of gametogenesis & fertilization process ● will be acquiring knowledge about different disorders 	

Unit -1 Male Reproductive System (06 hours)

- 1.1 Gross Anatomy & Functions of Organs
- 1.2 Internal & external anatomy of testis & Gonadogenesis
- 1.3 Reproductive System ducts in Males (from embryonic level)
- 1.4 Accessory Sex Glands

Unit 2 Female Reproductive System (08 Hours)

- 2.1 Gross Anatomy & functions of Organs
- 2.2 Internal anatomy of Vagina & Gonadogenesis

Unit 3 Histology (07 Hours)

- 3.1 Testes
- 3.2 Penis
- 3.3 Ovaries
- 3.4 Uterus

Unit-4 Introduction to Gametes (05 Hours)

- 4.1 Semen
- 4.2 Structure of Sperm
- 4.3 Cervical Mucus
- 4.4 Structure of Ovum

Unit-5 Reproduction of Gametes (08 Hours)

- 5.1 Spermatogenesis
- 5.2 Follicular Development (Folliculogenesis)
- 5.3 Oogenesis
- 5.4 Female Reproductive Cycle

Unit-6 Fertilization (09 Hours)

- 6.1 Semination, Ejaculation, Ovulation
- 6.2 Activation, Sperm Motility & Sperm Capacitation process
- 6.3 Acrosomal Reaction of Sperm
- 6.4 Ovum Activation & Ooplasm Segregation
- 6.5 Sperm- Oocyte Interaction & Fertilization (PN stage)



Unit-7 Female Factor Infertility (08 Hours)

- 7.1 Pelvic Inflammatory Disease
- 7.2 PCOD/PCOS
- 7.3 Endometriosis & adenomyosis
- 7.4 Menstrual Disorders
- 7.5 Ovarian Cancer
- 7.6 Uterine Fibroids

Unit-8 Male Factor Infertility (07 Hours)

- 8.1 Hypogonadism
- 8.2 Erectile Dysfunction, Varicocele, Epididymitis
- 8.3 Prostate & Testicular Cancer
- 8.4 Primary Testicular Failure

References:

1. B D Chaurasia's Human Anatomy 9th Ed, 4 Volume Set (PB - 2023) - B. D. Chaurasia and Krishna Garg
2. Principles of Anatomy & Physiology by Gerard J Tortora & Bryan H Derrickson, Wiley Pub.
3. Text Book of Medical Physiology by Guyton & Hall, Elsevier
4. TextBook of Gynaecology by D C Dutta
5. In Vitro Fertilization by Kay Elder & Brian Dale- 3rd Ed. , Cambridge University Press

Practicals:

- 1) To study permanent histological slides of ovaries, testis, sperms, ovum, endometrium
- 2) To study menstrual cycle by symptom tracker
- 3) To study ovulation by cycle tracker
- 4) To study use of ovulation test kit
- 5) To study different disorders with the help of charts & photographs
- 6) Visit to Gynecology Department of a Hospital
- 7) Visit to Cancer Hospital



Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	I		Effective From	July 2025		
Course Code	MSBT26101	Course Name	Practical			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
8	0	0	8	140	60	200



Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	I		Effective From	July 2025		
Course Code	MSBT23101	Course Name	Assisted Reproductive Technology (ART) - I			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
4	4	0	0	70	30	100



Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Embryology	Type: Theory + Practicals
Subject: SEC 1 Assisted Reproductive Technology (ART) - I	Semester: 1
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 Lab wares

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.



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Semester 2

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	II		Effective From	July 2025		
Course Code	MSBT21203	Course Name	Andrology Lab Techniques and Cryobiology			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
4	4	0	0	70	30	100



Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Biotechnology	Type: Theory + Practical
Subject: DSC-3 Andrology Lab Techniques And Cryobiology	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 male infertility & cryopreservation of gametes. It will provide fundamental knowledge about semen, sperms disorders, and cryopreservation.	
Student Learning Outcome: After completion of this course student will be <ul style="list-style-type: none"> ● Well informed about semen & sperm disorders ● Will understand the process & protocols of cryopreservation. ● will be able to identify male factor infertility & learn techniques to manage it ● will be skilled for sperm processing, sperm retrieval & cryopreservation of gametes important to IVF 	

Unit -1 Semen Analysis & Assessment of Male (06 hours)

- 1.1 Sample Collection & Physical Parameters
- 1.2 Microscopic Examination, Sperm Concentration, Sperm Motility,
- 1.3 Sperm Morphology & related disorders
- 1.4 Tests for Sperm Membrane Integrity

Unit 2 Sperm Preparation for IVF (09 Hours)

- 2.1 Assessment of Sperm DNA – chromatin & antisperm antibodies
- 2.2 Acrosome reaction & Biochemical Measurement of sperm function
- 2.3 Semen Preparation & Patient Preparation
- 2.4 Techniques of Sperm Preparation

Unit 3 Sperm Retrieval Techniques (06 Hours)

- 3.1 Ejaculation & Electroejaculation ,Retrograde Ejaculation
- 3.2 TESA, TESE,
- 3.3 MESA, PESA
- 3.4 micro-TESE, sperm Isolation from Urine (Retrograde ejaculation)

Unit-4 Infertility and Insemination (06 Hours)

- 4.1 Sperm Disorders
- 4.2 Environmental & Lifestyle factors, sperm defects & infertility.
- 4.3 Methods of Insemination
- 4.4 Conventional IVF & Advanced Sperm Selection Techniques for ICSI

Unit-5 Overview of Cryobiology in ART (07 Hours)

- 5.1 Definitions, principles of cryobiology, Thermodynamics
- 5.2 Concept of latent heat & Biology of Cryofreezing
- 5.3 Cryoprotectants
- 5.4 Steps of Cryopreservation

Unit-6 Gamete Cryopreservation Techniques (09 Hours)

- 6.1 Events during freezing & freeze injuries
- 6.2 Events during thawing & thaw injuries
- 6.3 Oocyte Cryopreservation (Vitrification & thawing)
- 6.4 Sperm cryopreservation (Sperm Vitrification, slow freezing & thawing)



Unit-7 Vitrification (09 Hours)

- 7.1 Principles of Vitrification & cryoprotectants
- 7.2 Vitrification Methods
- 7.3 Vitrification Devices
- 7.4 Preventing potential contamination from liq. Nitrogen

Unit-8 Ovarian Cortex Freezing & Cryo-Banking (06 Hours)

- 8.1 Indications for ovarian cryopreservation & assessment of ovarian reserve
- 8.2 ovarian tissue collection & preparation
- 8.3 Ovarian Cortex Freezing Process & its limitations
- 8.4 Sperm & Oocyte Banks

References:

1. Talwar, Lt Pankaj. Step by Step: Protocols in Clinical Embryology and ART. JP Medical Ltd, 2012.
2. IVF Techniques For the Beginners – Kuldeep Jain & Pankal Talwae, Jaypee Brothers Medical Pub.
3. A Practical Guide To Setting Up An Ivf Lab, Embryo Culture Systems & Running The Unit – Alex C Varghese, peter Sjoblom & K Jayaprakasan, Jaypee brothers' medical Pub
4. Textbook Of Assisted Reproductive Techniques Volume 1: Lab Perspectives By Dvid Gardner, Areil Weissman, Colin M Howles, Zeev Shoham, CRC Press, 5th Edition
5. Textbook Of Assisted Reproductive Techniques Volume 2: Clinical Perspectives by David Gardner, Areil Weissman, Colin M Howles, Zeev Shoham, CRC Press, 5th Edition

Practicals

- 1) Physical & Microscopic Examination, Biochemical tests of semen
- 2) To perform different techniques of semen analysis
- 3) To perform different sperm separation methods
- 4) To perform sperm cryopreservation
- 5) To perform Sperm DNA fragmentation test
- 6) To study sperm disorders by microscopy
- 7) To study Antisperm Antibodies tests



Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	II		Effective From	July 2025		
Course Code	MSBT21204	Course Name	Endocrinology and Developmental Biology			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
4	4	0	0	70	30	100



Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Biotechnology	Type: Theory + Practicals
Subject: DSC-4 Endocrinology and 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 College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	II		Effective From	July 2025		
Course Code	MSBT26202	Course Name	Practical			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
8	0	0	8	140	60	200



Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.CE		
Year	I		Version	2		
Semester	II		Effective From	July 2025		
Course Code	MSBT23202	Course Name	Genetics and Preimplantation Genetic Diagnosis (PGD)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
4	4	0	0	70	30	100



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
<p>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.</p>	
<p>Student Learning Outcome: After completion of this course student will be able to:</p> <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.

