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Accredited “B” Grade (2.67 CGPA) By NAAC
Accredited “B” Grade (2.92 CGPA) By AAA
GSIRF ‘4 STAR’ (3.5 CGPA)



Faculty of Science

Shree Ramkrishna Institute of Computer Education & Applied Sciences

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Department of Biotechnology

M.Sc. (Clinical) Embryology

in collaboration with

BLISS IVF - Fertility & Andrology

Institute, Surat

Program Regulations for M.Sc (Clinical) Embryology

About M. Sc (Clinical) Embryology Course

The Master of Science (M.Sc.) in (Clinical) Embryology is a specialized postgraduate program designed for individuals aiming to pursue a career in reproductive medicine and assisted reproductive technologies (ART). This comprehensive course provides an in-depth understanding of embryology, the branch of biology that studies the development of gametes, fertilization, and the development of embryos and fetuses. It combines theoretical knowledge with practical training, covering subjects such as reproductive physiology, molecular genetics, and advanced laboratory techniques. Graduates of this program are equipped with the expertise to work in fertility clinics, research institutions, and academic settings, contributing to the advancement of reproductive health and the treatment of infertility.

The syllabus of the M.Sc. (Clinical) Embryology program is meticulously designed to provide a robust foundation in both the theoretical and practical aspects of embryology and reproductive sciences. The curriculum encompasses a wide array of subjects, including reproductive anatomy and physiology, molecular biology, genetics, and endocrinology, all of which are essential for understanding human reproduction and development. Practical modules offer hands-on training in advanced laboratory techniques such as in vitro fertilization (IVF), embryo culture, cryopreservation, and micromanipulation. Additionally, the program covers ethical, legal, and psychosocial aspects of reproductive medicine, ensuring that students are well-prepared to navigate the complexities of clinical practice. Through a blend of lectures, laboratory sessions, and research projects, students gain the skills and knowledge necessary to excel in the field of clinical embryology and contribute to innovations in assisted reproductive technologies (ART). You will gain hands-on- training & practical knowledge during the entire course and will be enriched by subject knowledge which will make you outstanding in your professional life later.

Program Duration and Eligibility:

Duration	4 Semesters (2 Years)
Intake	15 Seats

Minimum Eligibility	<p>Bachelor's Degree (NCrF Credit Level 5.5 or equivalent) in any Branch of Biological Sciences, Pharmacy or Medicines (M.B.B.S. / B.A.M.S. / B.H.M.S / B.D.S.)</p> <p>The candidate who has passed eligibility exams in equivalent subjects other than mentioned above need to avail eligibility certificate for this programme from the Board of Equivalence (BoE) of Faculty of Science at the Sarvajanic University.</p>
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Teaching, Evaluation and Other Regulations:

All other regulations like those for teaching and examinations for this Program are the same as approved for other M.Sc. Programs by the Faculty of Science.

Name of Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Embryology	Type: Theory + Practical
Subject: DSC-1 Cell Biology & Molecular Techniques With Proteomics & 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. 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 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 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 Faculty: Science	Department: Biotechnology
Program: M.Sc. Clinical Biotechnology	Type: Theory + Practical
Subject: SEC-1 Andrology Lab Techniques & Cryobiology	Semester: 1
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 Talwar, 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 David 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