

SUMANDEEP VIDYAPEETH

(Declared as Deemed to be University under Section 3 of the UGC Act 1956)

Accredited by NAAC with a CGPA of 3.53 out of four-point scale at 'A' Grade

Category – I deemed to be university under UGC Act - 2018

At & Post Piparia, Tal: Waghodia 391760 (Gujarat) India.

Ph: 02668-245262/64/66, Telefax: 02668-245126,

Website: www.sumandeepvidyapeethdu.edu.in



CURRICULUM Master of Science (M.Sc) CLINICAL EMBRYOLOGY

Attested CTC

Sharaney
15/2/2021

Vice-Chancellor
Sumandeep Vidyapeeth
An Institution Deemed to be University
VIII. Piparia, Taluka: Waghodia.
Dist. Vadodara-391 760. (Gujarat)

Polwade



Manchanda



AMENDED UP TO DECEMBER -2020

1. Goal

The goal of postgraduate M.Sc in Clinical Embryology shall be to produce competent Clinical Embryologists and leaders in reproductive sciences.

2. Program Outcome

After completing two years of M.Sc. Clinical Embryology, the post graduate student should be able to:

PO-1: Work as a Competent Embryologist

PO-2: Acquire knowledge and skills in Reproductive Educational Technology and conduct research in Reproductive Sciences.

3. Course Outcomes

After completing the course of M.Sc. Clinical Embryology, the post graduate student should be able to:

- 3.1 Demonstrate comprehensive knowledge and understanding of gross and microscopic structure of the human cell and its organelles.
- 3.2 Comprehend normal anatomy and physiology of the male and female re-productive system.
- 3.3 Demonstrate knowledge of basic and systemic embryology including human genetics, genetic inheritance, gene regulation, immunology and stemcell therapy.
- 3.4 Develop a basic understanding of biochemistry, endocrinology and pharmacology.
- 3.5 Independently handle semen and its processing for both techniques- IntraUterine Insemination (IUI) and In-vitro fertilization (IVF).
- 3.6 Be acquainted with mouse anatomy and physiology.
- 3.7 Should be able to identify and handle human oocyte in the embryology laboratory.
- 3.8 Competently handle human gametes in the scenario of IVF and ICSI.
- 3.9 Assess viability of embryos and their developmental competence with fair accuracy.
- 3.10 Cryopreserve human gametes and embryos, thaw them and subsequently develop them to transfer into the uterus.
- 3.11 Understand the basic concepts of IVF.
- 3.12 Should be well versed in setting up of IVF laboratory according to standards available and well versed in quality control measures.

4. Admission:

4.1 Eligibility

- a. The student is required to obtain at least 50% in his/her bachelor's program.
- b. As a minimum criterion of eligibility, aspiring candidates are needed to have attained a B.Sc. in any discipline of Life Sciences, Biosciences, Bachelor's degree in any of Physics, Biological Sciences, M.B.B.S, BDS, BAMS, BHMS, B.Pharm, Bachelor's Degree in Agricultural Sciences from an Institute recognized by respective Statutory Council/ UGC.

4.2 There is no age bar for applying.

4.3 Fee structure and Reservation

a. As laid down by Sumandeep Vidyapeeth Deemed to be University.

Attested OTC

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4.4 Duration of the Course: Two years which is divided into four semesters each of six months duration

5. Course Content

5.1 Semester-I

	Theory	Teaching Hours/ week
Subject Code	Subject	
MCE101	Basics of Biochemistry and Cell Biology	4
MCE 102	Reproduction and Embryology-I (Basics)	4
MCE 103	Reproductive Anatomy	4
MCE 104	Reproductive Physiology	4
MCE105	Research Methodology-I (Including Research project / Dissertation topic selection)	4
	Practical	
MCE106	Laboratory Techniques-I (Including Seminars/Journal Club)	4
	Extra-curricular activities	4
	Total Hours	28

5.2 Semester-II

	Theory	Teaching Hours/ week
Subject Code	Subject	
MCE 201	Molecular Biology and Immunology	4
MCE 202	Reproduction and Embryology-II	4
MCE 203	Clinical Aspects of Reproduction	4
MCE 204	Research Methodology-II (Including Research project / Dissertation work and Biostatistics)	8
	Practical	
MCE 205	Laboratory Techniques-II (Including Seminars/Journal Club)	4
	Extra-curricular activities	4
	Total Hours	28

5.3 Semester-III

	Theory	Teaching Hours/ week
Subject Code	Subject	
MCE 301	Basics of Microbiology and Pharmacology	4
MCE 302	Assisted Reproductive Techniques-I (Basics)	4
MCE 303	Ethics, Regulatory laws & Guidelines	4
MCE 304	Research Methodology-III (Including Research project / Dissertation work and Research ethics)	4
	Practical	
MCE 305	Laboratory Techniques-III (Including Seminars/Journal Club)	6
	Extracurricular activities	4
	Total Hours	26



5.4 Semester-IV

	Theory	Teaching Hours/ week
Subject Code	Subject	
MCE 401	Good Laboratory Practices	4
MCE 402	Assisted Reproductive Techniques-II (Recent Advances)	2
MCE 403	Research Project and Dissertation work (Submission at the end of first half)	14
	Practical	
MCE 404	Laboratory Techniques-IV (Including Seminars/Journal Club)	8
	Total Hours	28

6. Syllabus

6.1 Semester-I

	Theory
Subject Code	Subject
MCE101	Basics of Biochemistry and Cell Biology <ol style="list-style-type: none"> Structure of the building blocks – Proteins, Carbohydrates, Nucleic acids, Lipids Enzymes – How Enzymes Work; Enzyme Kinetics Biological Membranes and Transport Bioenergetics and Biochemical Reaction Types Carbohydrate metabolism – Glycolysis, Kreb’s cycle, Gluconeogenesis Lipid Biosynthesis & Fatty Acid Catabolism Biosynthesis of Amino Acids, Nucleotides, and Related Molecules Amino Acid Oxidation and the Production of Urea Hormonal Regulation and Metabolism Cell organization; Intracellular compartments Cytoskeleton & Cell Dynamics Cell junctions; Cell adhesion; Extracellular Matrix; Cell migration Cell signaling – Typical ligand-receptor systems; Intracellular signaling systems; Signal transduction Cell growth & Division – Basic mechanism of mitosis & apoptosis Oncogenes, Tumor Suppressor Genes, and Programmed Cell Death Overview of Molecular Genetics; Cytogenetics & Molecular cytogenetics Epigenomics; Gene cloning; Gene therapy
MCE 102	Reproduction and Embryology-I (Basics) <ol style="list-style-type: none"> Gametogenesis: Conversion of germ cells into male gametes Gametogenesis: Conversion of germ cells into female gametes Ovulation (ovarian cycle, menstrual cycle) Fertilization Implantation Bilaminar germ disc Trilaminar germ disc The embryonic period (overview) The fetus
MCE 103	Reproductive Anatomy <ol style="list-style-type: none"> Male reproductive system (gross anatomy, neuroendovascular supply) Female reproductive system (gross anatomy, neuroendovascular supply)
MCE 104	Reproductive Physiology <ol style="list-style-type: none"> Mechanism of action of hormone and receptor concerned with reproduction Neuroendocrine control of reproduction and feedback mechanism Hormones: gonadotropins, prolactin, melatonin Hormones: Testosterone, progesterone, testosterone Hormones: Inhibin B, AMH, Activin, Leptin, etc Hormones: T3, T4, TSH, Cortisol, DHEA



	<p>Metabolic control of reproduction</p> <p>c. Physiology of Pregnancy, parturition and lactation Basics of immune system</p> <p>d. Immunophysiology of male and female reproduction</p> <p>e. Immunology of pregnancy Pubertal changes</p> <p>f. Reproductive Ageing – Menopause; Andropause Sexual behavior – Male & Female</p> <p>g. Epigenetics of reproduction</p> <p>h. Methods of fertility regulation in male and female</p> <p>i. Prevention of sexually transmitted diseases and Reproductive health Reproductive toxicology</p>
MCE105	<p>Research Methodology-I (Including Research project / Dissertation topic selection)</p> <p>a. Introduction to research methodology- Types of research, Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Some Other Types of Research</p> <p>b. Study Designs-Observational Studies- Epidemiological study designs; Observational studies, Descriptive studies; Case reports, Case series, Analytical studies; Case control studies, Cohort studies, Cross sectional</p> <p>c. Experimental Studies- Experimental studies (Intervention studies); Randomized control trials (Clinical trials), Field trials, Community trials.</p> <p>d. Literature Search and Search engines</p> <p>e. Sources of evidence and level of evidences</p>
	Practical
MCE106	<p>Laboratory Techniques-I (Including Seminars/Journal Club)</p> <p>1. Basic instrumentation</p> <p>A. pH meter</p> <p>B. Centrifuges</p> <p>C. Microscopes</p> <p>D. Electrophoresis</p> <p>E. Water bath</p> <p>F. Incubator</p> <p>2. Genetic Manipulation / Nucleic Acid-related Techniques</p> <p>A. Isolation of genomic DNA</p> <p>B. Isolation of RNA and cDNA preparation</p> <p>C. Amplify DNA by PCR</p> <p>D. Agarose gel electrophoresis</p> <p>E. Cloning of DNA into plasmid</p> <p>F. Transformation of plasmid into bacteria</p> <p>3. Protein-related Techniques</p> <p>A. 1-D SDS-PAGE(Polyacrylamide gel electrophoresis)</p> <p>B. 2-D PAGE (Polyacrylamide gel electrophoresis)</p> <p>C. Western Blotting</p>
	Extra-curricular activities

6.2 Semester-II

	Theory
Subject Code	Subject
MCE 201	<p>Molecular Biology and Immunology</p> <p>a. Central Dogma of Molecular Biology- DNA Replication; Mutations & Repair Mechanisms; Recombination Transcription – Synthesis of RNA; RNA Processing; Regulation Translation – Mechanism; Regulation</p>



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	<p>b. Protein Metabolism – Synthesis; Targeting and Degradation</p> <p>c. Regulation of Gene Expression</p> <p>d. Molecular Diagnostics- Blotting techniques, DNA Cloning, DNA recombinant technology, Polymerase chain reaction, Fluorescent in-situ hybridization, Microarray technique, Recent advances</p> <p>e. Basics of Immunology-Antigens, Antibodies, Vaccines, Immunology of pregnancy, Clinical aspects</p> <p>f. Corona Virus- Introduction, History, Taxonomy and Evolution, Emergence, Spread, Outbreak, Pandemic and Prevalence, Types and Variants, Diagnostics, Vaccines and Therapeutics, Precautions and Challenges in combating, Post infection effects <i>(Board of Studies letter no.: SBKSMIRC/Dean/874, dated 18/06/2020 and Vide Notification of Board of Management Resolution Ref: No. SVDU/R/3383-A/2019-20 dated 31/07/2020)</i></p>
MCE 202	<p>Reproduction and Embryology-II</p> <p>a. The fetal membranes and placenta Birth defects and prenatal diagnosis</p> <p>b. Development of male reproductive system I (Gonads, genital ducts, glands)</p> <p>c. Development of male reproductive system II (External genitalia, descent of testis)</p> <p>d. Development of female reproductive system I (Gonads, genital ducts, glands)</p> <p>e. Development of male reproductive system II (External genitalia, descent of ovaries)</p>
MCE 203	<p>Clinical Aspects of Reproduction</p> <p>a. Sexual differentiation & developmental abnormalities – male & female Menstrual disorders – Precocious, delayed or absent puberty; Amenorrhea Fertility disorders – Sexual dysfunction; Infertility; Spontaneous pregnancy loss Pregnancy disorders – Pre-eclampsia, IUGR, Labour abnormalities</p> <p>b. Endocrine disorders – Hyperprolactinemia Autoimmune disorders</p> <p>c. Genetic disorders (mutations and syndromes)</p> <p>d. Cancers and biomarkers – Testicular; Prostate; Ovarian; Endometrial; Cervical; Breast</p> <p>e. Reproductive pathology</p>
MCE 204	<p>Research Methodology-II Biostatistics (Including Research project / Dissertation work and)</p> <p>a. Introduction to Biostatistics - scope & need for the application of statistical methods in medical and biological data</p> <p>b. Definition of different terms in statistical methods - Scale of measurements; Methods of data collection</p> <p>c. Presentation of data - statistical tables, diagrams and graphs; Needs for reduction of data - measures of average and location</p> <p>d. Measures of dispersion - Range, quartile deviation, mean deviation and standard deviation; Concepts of statistical population and sample - need for sampling studies, Simple procedures of random sampling; Methods of sampling</p> <p>e. Probability: Basic concepts and theorems of probability</p> <p>f. Standard error, estimation and testing the statistical significance; Test of significance: Normal deviate test (Z test); Student's t tests; Chi-Squared test; F - Test and one way analysis of variance and multiple range tests; Two way analysis of variance and multiple range test; Non-Parametric statistical methods; Correlation - definition and application;</p>



	Regression - definition and application; Statistical methods in Diagnostic Tests
	Practical
MCE 205	Laboratory Techniques-II (Including Seminars/Journal Club) <ul style="list-style-type: none"> 1. Cell Biology Techniques <ul style="list-style-type: none"> A. Cell line culture & maintenance B. Phase contrast microscopy / photography C. Bright-field & fluorescence microscopy D. Immunocytochemistry E. Transfection of cell line 2. Immunobiology Techniques <ul style="list-style-type: none"> A. Radioimmuno assay (RIA) B. Enzyme linked Immuno Assay (ELISA) C. Chemiluminescent Immunoassay (CMIA) Automated – Demo only 3. Molecular Cytogenetics Techniques <ul style="list-style-type: none"> A. Karyotyping B. Fluorescent In Situ Hybridization (FISH) C. PCR & Real-Time PCR D. QF-PCR / Genetic Analyzer
	Extra-curricular activities

6.3 Semester-III

	Theory
Subject Code	Subject
MCE 301	Basics of Microbiology and Pharmacology <ul style="list-style-type: none"> a. Sterilization- Autoclave Incineration Plasma sterilization, Microwave Sterilization b. Disinfection- Low level disinfectants and uses, Mid level disinfectants and uses, High level disinfectants and uses, Disinfection in a tertiary care hospital and biosafety cabinet c. Nosocomial infection- Surgical site infection(SSI), Ventilator associated pneumonia, Central line associated blood stream infection, Catheter associated urinary tract infection, Hand wash technique d. Sexually transmitted diseases- HIV,HBV,HCV, White discharge per vagina Ulcers, Bubo Pustules e. TORCH infections- Toxoplasmosis, Rubella, Cytomegalovirus, Herpes virus, Syphilis f. Genital tuberculosis and infertility g. General Pharmacological Principles- Routes of drug administration Novel drug delivery systems, Drug dosage forms, h. Pharmacokinetics- Absorption, Distribution, Metabolism, Excretion of drugs i. Pharmacodynamics- Receptors and transducer mechanisms, Adverse Drug Reactions (including Teratogenicity) j. Hormones and related Drugs- Anterior Pituitary hormones, Posterior Pituitary hormones (Oxytocin and Vasopressin Other drugs acting on uterus), Sex Hormones (Estrogens & Anti estrogens, Progesterone & Anti-Progesterone, Oral Contraceptives pills, Various hormonal dosage forms, Androgens & Anti-Androgens), Thyroid hormone and thyroid inhibitors, Diabetes Mellitus -Insulin and Oral hypoglycaemic



	<p>drugs Corticosteroids</p> <p>k. Treatment of Infertility- Treatment of erectile dysfunction and male infertility Drugs therapy of Female Infertility</p> <p>l. Screening Methods for anti-fertility agents- Evaluation of drugs for female infertility, Evaluation of drugs for male infertility</p>
MCE 302	<p>Assisted Reproductive Techniques-I (Basics)</p> <p>a. Semen analysis</p> <p>b. Ovulation induction; Oocyte retrieval; In vitro maturation In vitro fertilization</p> <p>c. ICSI, GIFT etc.</p> <p>d. Cryopreservation of gametes & embryos; Vitrification Embryo biopsy; Embryo hatching</p> <p>e. Pre-implantation genetic diagnosis (PGD)</p> <p>f. Stem cells & therapeutic cloning</p>
MCE 303	<p>Ethics, Regulatory laws & Guidelines</p> <p>a. Ethical practices</p> <ul style="list-style-type: none"> • National legislation (what is allowed in your country) • Ethical consideration • Code of practice <p>b. National & International guidelines for ART Laws regulating gamete donors & surrogacy</p>
MCE 304	<p>Research Methodology-III (Including Research project / Dissertation work)</p> <p>1. Research Ethics and Principles</p> <p>2. Uses of epidemiology</p> <p>3. Applications of Research Designs in Medical Research</p> <p>4. Scientific writing</p> <p>5. Presentation of Research work</p>
	Practical
MCE 305	<p>Laboratory Techniques-III (Including Seminars/Journal Club)</p> <p>1. Reproductive Biology Techniques (Mouse model)</p> <p>A. Super-ovulation</p> <p>B. Isolation of oocytes and sperm from mice</p> <p>C. In Vitro Fertilization (IVF)</p> <p>D. Culture of zygote to blastocyst stage</p> <p>E. Mating & checking copulation plug</p> <p>F. Collection & isolation of pre-implantation embryo</p> <p>G. In vitro maturation of GV-stage oocytes</p> <p>H. Intra-Cytoplasmic Sperm Injection (ICSI) / Micromanipulation</p> <p>I. Sperm / oocyte / zygote cryopreservation</p>
	Extracurricular Activities

6.4 Semester-IV

	Theory
Subject Code	Subject
MCE 401	<p>Good Laboratory Practices Attended CTC</p> <p>a. Cryopreservation programme & quality assurance</p> <ul style="list-style-type: none"> • Principles for freezing and thawing of cells • Basic cryobiology • Cryoprotectants, additives • Slow freezing



- Vitrification, timing
- Advantages/ disadvantages with different methods
- b. Sperm freezing / thawing
 - Theory and practice
- c. Oocyte freezing/ thawing or vitrification /warming
 - Theory and practice
- d. Embryo freezing / thawing or vitrification /warming
 - Theory and practice
- e. Ovarian freezing /thawing or vitrification/warming
 - Theory and practice
- f. Testicular freezing / thawing
 - Theory and practice
- g. Equipment
 - Machines
 - Straws/ampoules
 - Media, contamination from storage medium (what and why)
 - Minimal safety requirements
 - Security
- h. The FET treatment cycle
 - Monitoring and timing of the FET-cycle
 - Natural cycles
- i. Quality assessment, statistics, handling data, ethics, legislation- Patient data
 - Identity check
 - confidentiality
 - keeping records
 - safety
 - coding
- j. Quality assurance
 - Identification procedures
 - Monitoring of performance, index variables
 - SOP's
 - traceability
 - validations
 - monitoring, use of key performance indicators
 - logbooks
 - If/ how/when to bring in new methods
- k. Staff protection
 - Hygiene,
 - Rules and regulations,
 - Protective measurements (gloves, masks etc)
 - Actions upon injury

MCE 402

Assisted Reproductive Techniques-II (Recent Advances)

- a. Innovative techniques in human embryo viability assessment
 - Transcriptomics
 - Proteomics, Metabolomics
 - Time-lapse embryo development monitoring system
- b. Sperm selection methods
 - IMSI ((Intracytoplasmic Morphologically-selected Sperm Injection)
 - PICSI (Physiological Intra-Cytoplasmic Sperm Injection)
 - Sperm slow: For slowing down the movement of the sperm to allow for the selection of the most mature, viable spermatozoa for ICSI
 - ROSNI (Round Spermatid Nucleus Injection)



	<ul style="list-style-type: none"> MACS (Magnetic-Activated Cell Sorting) <p>c. Mitochondrial transfer techniques Risks in the IVF Laboratory</p> <ul style="list-style-type: none"> Contaminated samples Processing and storage of sample known/suspected to be contaminated with contagious agents <p>d. Adverse events, back-up strategies</p> <ul style="list-style-type: none"> How to avoid, what to do? e.g. Mix-up of gametes, loss or damage during handling Transfer of wrong embryos Breakdown of equipment, back-up strategies <p>e. Trouble shooting</p>
MCE 403	Research Project and Dissertation work (Submission at the end of first half)
	Practical
MCE 404	Laboratory Techniques-IV (Including Seminars/Journal Club)
	<ol style="list-style-type: none"> Practicals aspects related to MCE404 Reproductive Biology Techniques (Human) <ul style="list-style-type: none"> A. Semen analysis – Manual & CASA; Sperm capability B. Human IVF lab – Rotation & Demo only

7. Scheme of Evaluation

7.1 Semester Examination

7.1.1 Internal Examination

Theory

Total marks: 30 (Calculated from Best of two internal exams)

Total internal examinations to be conducted: 02

Practical

Total marks: 20 (Calculated from Best of two internal exams)

Total internal practical examinations to be conducted: 02

7.1.2 End-semester Examination

Theory

Total Marks: 100 (70 + 30 internal marks)

Practical

Total Marks: 50 (30 + 20 internal marks)

7.1.3 Passing standard: 50%

8. Paper Pattern

8.1 Internal Theory Exam

Time 1.5 hours	Max. Marks 30
Question-1 Write answers to Objective type of questions (Any 05)	5x1= 05
Question-2 Write short answer questions (Any 10)	10x2= 20
Question-3 Long answer question (Any one)	1x5= 05

8.2 Internal Practical Exam

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Time 2 hours	Max. Marks 20
Question-1 Major exercise/s	10
Question-2 Minor Exercise/s	05
Question-3 Viva-voce	05

8.3 End-semester Theory Exam

Time 3 hours	Max. Marks 70
Question-1 Write answers to Objective type of questions (Any 10)	10x1= 10
Question-2 Write short answer questions (Any 10)	10x5= 50
Question-3 Long answer question (Any one)	1x10= 10

8.4 End-semester Practical Exam

Time 3 hours	Max. Marks 30
Question-1 Major exercise/s	15
Question-2 Minor Exercise/s	05
Question-3 Viva-voce (with dissertation presentation in semester-IV)	10

9. Project/ Dissertation work

- Project work will be carried out individually and mandatorily.
- Projects will be allotted by the end of semester II.
- In-house projects are preferred.
- Students may be allowed to carry out the project work in collaboration with other research institutes, start-ups or larger companies.
- Co-guides from the collaborating institution/company are allowed.
- Internal assessment on project work will be made by the guide/s for 30 marks and will be based on the student's day to day performance in the laboratory.
- The dissertation will be evaluated by two external examiners.
- The project viva voce examination will be held during practicals at the end of last semester. The mark for the same will be added in the practical.

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