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Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

(Re-accredited by NAAC at 'A')

(NIRF-2022 Ranked 33 in University Category & 54 in Overall Category)

No.: PMEB-1/Spl./28(9)/2021-22

Date: 03-11-2022

Sub.: Minor modification in the syllabus of **M.Sc. (Clinical Embryology & Pre implantation Genetics)** course under Specialized Programs from the academic year 2022-23-reg.

- Ref.: 1. Decision of the BOS Meeting held on 03-08-2022.
2. Decision of the Faculty of Science & Technology meeting held on 15-09-2022.
3. Decision of the Academic Council meeting held on 23-09-2022.

The Board of Studies in **M.Sc. (Clinical Embryology & Pre implantation Genetics) (PG)** at its meeting held on 03-08-2022 has resolved and recommended modification in the syllabus of **M.Sc. (Clinical Embryology & Pre implantation Genetics)** course under specialized/specified programs from the academic year 2023-23.

The Faculty of Science & Technology and the Academic Council at their meetings held on 15-09-2022 and 23-09-2022 respectively, have also approved the above said proposal and the same is hereby notified.

The modified syllabus of **M.Sc. (Clinical Embryology & Pre implantation Genetics)** course may be downloaded from the University website <https://uni-mysore.ac.in/PMEB/>.


REGISTRAR
REGISTRAR
University of Mysore
MYSURU - 570 005
4/11/22

To;

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DoS in Earth Science, Manasagangothri, Mysuru.
3. Prof. Gopal Marathe, DoS in Biochemistry, Manasagangothri, Mysuru.
4. The Director, Asia Pacific Institute of Embryology, #12246/A, Vijayanagara 4th Stage, 2nd phase, Outer Ring Road, Mysuru,
5. The Deputy Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
7. Office Copy.

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Proceedings of the Board of Studies Meeting for the subject MSc. (Clinical Embryology and Preimplantation Genetics).

Place: Asia Pacific Institute of Embryology

Date: August 3rd, 2022

Time: 2.00 PM

Members Present:

Prof Gopal Marathe – Chairman

Dr Suresh Kattera – Member

Dr Yogitha Rao – Member

Prof M Y Sreenivasa – Member

Dr K L Krishna – Member

Dr Muthukumar Serva Peddha – Member

Members Unable to Attend: Dr. Sowmya Dinesh, Dr Pushpalatha , Dr Prakash Savanur

The Chairman welcomed the members and initiated the Board of Studies Meeting for the subject M.Sc (Clinical Embryology and Preimplantation Genetics)

1. To create Clinical Embryology Discipline to award PhD: The Board Members suggested the formation of a separate Clinical Embryology Discipline. (Attached as Annexure 1)
2. Syllabus: The Committee made few changes in the curriculum looking into the advancement made in the Clinical Embryology and Preimplantation Genetics. Minimum changes of 20 – 40 % made in the syllabus for the academic year 2022-2024 (Attached as Annexure 2)
3. Examiners list: The list was revised and approved by the BOS Members (enclosed the same) shall be mailed to the Registrar (Evaluation) for reference.(Attached as Annexure 3)

The Chairman concluded the meeting by proposing vote of thanks.

Prof Gopal Marathe

Dr. Suresh Kattera

Dr. Yogitha Rao

Prof M Y Sreenivasa

Dr K L Krishna

Dr Muthukumar Serva Peddha

Syllabus (Annexure 2)

MSc (Clinical Embryology and Preimplantation Genetics) Regulations and Syllabus

I Semester (18 Credits)-No changes

Sl. No.	Code	Title of the Paper	Credit pattern			Total Credits
			L	T	P	
1		Introduction to Reproductive system	2	0	0	2
2		Introduction to infertility	2	0	0	2
3		Introduction to embryology laboratory	0	0	6	6
4		Andrology laboratory Techniques	0	0	8	8
			4	0	14	18

II Semester (20 credits)-No changes

Sl. No.	Code	Title of the Paper	Credit pattern			Total Credits
			L	T	P	
1		Principles of genetics and Reproductive Endocrinology	2	0	0	2
2		Assisted Reproduction	2	0	0	2
3		Clinical Embryology Techniques	0	0	8	8
4		Cryopreservation Techniques	0	0	8	8
			4	0	16	20

III Semester (20 credits)-No changes

Sl. No.	Code	Title of the Paper	Credit pattern			Total Credits
			L	T	P	
1		Research methodology and Preimplantation Genetic Diagnosis	2	0	0	2
2		Principles of Cryopreservation	2	0	0	2
3		Intracytoplasmic sperm injection (ICSI)	0	0	8	8
4		Micromanipulation & Embryo Biopsy Techniques	0	0	8	8
			4	0	16	20

IV Semester (20 credits)-No changes

Sl. No.	Code	Title of the Paper	Credit pattern			Total Credits
			L	T	P	
1		New developments in ART	2	0	0	2
2		Regulation and ethics in assisted reproduction	2	0	0	2
3		Research Seminar	0	4	0	4
4		Project Work	0	0	10	10
			4	4	10	18

I Semester**Theory Paper 1 Introduction to Reproductive System**

2 Credits

Lecture (2 Credits 2 hours / week)

Existing syllabus	Proposed Changes/additions
Introduction to Reproductive System	Introduction to Reproductive System
Introduction to Evolution, Cell biology, Anatomy Physiology, Genetics and development of vertebrates	Introduction to Evolution, Cell and molecular biology- somatic cells, Cell membranes, ER, microville, Cell cytoplasm, microtubules, microfilaments, centrioles, nucleus, active and inactive chromatin, mitochondria, Nuclear RNA, endoplasmic reticulum, golgi apparatus, metabolism of cell (mammalian), Reactive oxygen species, super Oxide Dismutase, methylation, DNA replication, Homeobox genes, Ribosomal RNA, Transfer RNA, Messenger RNA, Transcription in oocytes, Translation (Protein synthesis), cellular replication, mitosis, meiosis, chromosomes, chromatin, chromatids, centromere, Kinetochore, Diploid, Haploid, Aneuploid, HeLa cells.
Embryology; history and concepts	
Primordial germ cells. Gonadogenesis;	
Female reproductive system and female anatomy: development of ovary, oogenesis, folliculogenesis, and oocyte development, gamete transport, Fertilization, zygote formation & Cleavage, early development of embryos, Blastulation & gastrulation, Germ layer formation, implantation.	
Male Reproductive system and male anatomy; development of testes; spermatogenesis and spermiogenesis	
Seminal plasma and its composition, Biochemical analysis of semen sample, microbiological analysis of semen sample, Antisperm antibodies, Structure and function of spermatozoa,	Anatomy Physiology, Genetics and development of vertebrates
Preparation of embryology lab and personnel for oocyte retrieval, selection of culture media and disposables, Equilibration of culture tubes and dishes, composition of culture media, use of culture media for different purposes,	Embryology; history and concepts
Insemination procedures, Denudation and fertilization check, zygote, cleavage and blastocyst development assessment, Embryo Transfer	Primordial germ cells. Gonadogenesis;
	Female reproductive system and female anatomy: development of ovary, oogenesis, folliculogenesis, and oocyte development, gamete transport, Fertilization, zygote formation & Cleavage, early development of embryos, Blastulation & gastrulation, Germ layer formation, implantation.

	<p>Male Reproductive system and male anatomy; development of testes; spermatogenesis and spermiogenesis</p> <p>Seminal plasma and its composition, Biochemical analysis of semen sample, microbiological analysis of semen sample, Antisperm antibodies, Structure and function of spermatozoa, Preparation of embryology lab and personnel for oocyte retrieval, selection of culture media and disposables, Equilibration of culture tubes and dishes, composition of culture media, use of culture media for different purposes, Insemination procedures, Denudation and fertilization check, zygote, cleavage and blastocyst development assessment, Embryo Transfer</p>
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Theory Paper 2: Introduction to Infertility

2 Credits

Lecture (2 Credits 2 hours / week)

Existing	No changes
<p>Reproductive health, Infertility; definition, history, Incidence of infertility; global fertility rates and declining birth rates, society and infertility. Age and declining fertility, Causes of male infertility; anatomical causes and varicocele, hormonal causes, genetic causes, environmental causes</p> <p>Female infertility: Anatomical causes, hormonal causes, polycystic ovary syndrome, anovulation</p> <p>Investigation of male: Physical examination, semen examination and hormonal assessment</p>	<p>Reproductive health, Infertility; definition, history, Incidence of infertility; global fertility rates and declining birth rates, society and infertility. Age and declining fertility, Causes of male infertility; anatomical causes and varicocele, hormonal causes, genetic causes, environmental causes</p> <p>Female infertility: Anatomical causes, hormonal causes, polycystic ovary syndrome, anovulation</p> <p>Investigation of male: Physical examination, semen examination and hormonal assessment</p>

Investigation of the female: Physical examination, hormonal evaluation	Investigation of the female: Physical examination, hormonal evaluation
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Introduction to Embryology Laboratory Techniques

Practical Paper 1: (6 Credits, 12 hours / week)

Existing	No Changes
Introduction to Embryology Laboratory Techniques	Introduction to Embryology Laboratory Techniques
Embryology Laboratory: Standard Operating Protocols (SOPS); Various SOPS and work instructions in the embryology lab, Functions of IVF Centre and the laboratory, Personnel involved and workflow, Maintenance of lab and monitoring equipment, Personnel proficiency, inventory management, Quality control and Quality assurance. Familiarization and calibration of digital thermometer, Temperature monitoring of incubators, Laminar Flow, heating block and refrigerator, Familiarization of CO2 analyzer and CO2 measurement, Preparation of 70% alcohol, cleaning of CO2 incubator, Laminar Flow, Bench top incubators, Monitoring of CO2 and Triple gas cylinder pressures, Monitoring the level of liquid nitrogen in the liquid nitrogen Dewar of sperm and embryo storage tank Good laboratory practice, Tissue culture laboratory, Designing and layout of embryology laboratory, Requirements of embryology laboratory, clean air system, Embryology lab	Embryology Laboratory: Standard Operating Protocols (SOPS); Various SOPS and work instructions in the embryology lab, Functions of IVF Centre and the laboratory, Personnel involved and workflow, Maintenance of lab and monitoring equipment, Personnel proficiency, inventory management, Quality control and Quality assurance. Familiarization and calibration of digital thermometer, Temperature monitoring of incubators, Laminar Flow, heating block and refrigerator, Familiarization of CO2 analyzer and CO2 measurement, Preparation of 70% alcohol, cleaning of CO2 incubator, Laminar Flow, Bench top incubators, Monitoring of CO2 and Triple gas cylinder pressures, Monitoring the level of liquid nitrogen in the liquid nitrogen Dewar of sperm and embryo storage tank Good laboratory practice, Tissue culture laboratory, Designing and layout of embryology laboratory, Requirements of embryology laboratory, clean air system, Embryology lab

<p>equipment, disposables, culture media used in the laboratory</p> <p>Sterilization methods; autoclave, dry heat sterilization, gas sterilization and gamma radiation, Handling of hazardous and biological samples, Cleaning and maintenance of embryology laboratory, Common lab contaminants-bacteria, fungi and viruses; identification of bacilli and cocci, Gram stain</p> <p>Tissue culture techniques, culture media and formulation, familiarization of embryology lab equipment, embryology lab attire, sterile practice in the embryology laboratory</p> <p>Microscopy: Phase contrast microscope, stereo zoom microscope and inverted microscope</p> <p>Sheep Ovary dissection: identification of follicles on the ovary, isolation of oocyte cumulus complex and separation of oocytes, identification of granulosa cells, cumulus cells, corona cells and zona pellucida.</p> <p>Mitosis, Meiosis, Identification of cells in stained blood smear, blood grouping</p>	<p>equipment, disposables, culture media used in the laboratory</p> <p>Sterilization methods; autoclave, dry heat sterilization, gas sterilization and gamma radiation, Handling of hazardous and biological samples, Cleaning and maintenance of embryology laboratory, Common lab contaminants-bacteria, fungi and viruses; identification of bacilli and cocci, Gram stain</p> <p>Tissue culture techniques, culture media and formulation, familiarization of embryology lab equipment, embryology lab attire, sterile practice in the embryology laboratory</p> <p>Microscopy: Phase contrast microscope, stereo zoom microscope and inverted microscope</p> <p>Sheep Ovary dissection: identification of follicles on the ovary, isolation of oocyte cumulus complex and separation of oocytes, identification of granulosa cells, cumulus cells, corona cells and zona pellucida.</p> <p>Mitosis, Meiosis, Identification of cells in stained blood smear, blood grouping</p>
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Andrology Laboratory Techniques

Practical Paper 2 (8 Credits 12 hours / week)

Andrology Laboratory Techniques

8 credits (12hours/week)

Existing	No changes
Andrology Laboratory Techniques	Andrology Laboratory Techniques
Male anatomy model; Sheep testes dissection and processing, identification of stages of sperm development, identification of sperm and its morphology	Male anatomy model; Sheep testes dissection and processing, identification of stages of sperm development, identification of sperm and its morphology

<p>Semen analysis; normospermic and oligospermic semen samples, calculation of spermatozoa concentration, motility grading, morphology assessment in stained and neat semen samples, assessment of viability, examination for sperm agglutination, differentiation of immature spermatogenic cells and pus cells (peroxidase test), Fructose test to rule out obstructive azoospermia, Tests for antisperm antibodies (Mar test), Sperm DNA fragmentation test, HOST test, Sperm survival test, Hyaluronan binding assay</p> <p>Sperm separation methods; classical swim up method, standard swim up method, gradient method, SEPD method</p> <p>Semen Cryopreservation</p>	<p>Semen analysis; normospermic and oligospermic semen samples, calculation of spermatozoa concentration, motility grading, morphology assessment in stained and neat semen samples, assessment of viability, examination for sperm agglutination, differentiation of immature spermatogenic cells and pus cells (peroxidase test), Fructose test to rule out obstructive azoospermia, Tests for antisperm antibodies (Mar test), Sperm DNA fragmentation test, HOST test, Sperm survival test, Hyaluronan binding assay</p> <p>Sperm separation methods; classical swim up method, standard swim up method, gradient method, SEPD method</p> <p>Semen Cryopreservation</p>
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Semester 2

Paper 1 : Principles of Genetics and Reproductive endocrinology

2 Credits

Lecture (2 Credits, 2 hours / week)

Existing	No changes
<p>Mendelian Inheritance – Autosomal Recessive, Autosomal Dominant</p> <p>Atypical Mendelian Inheritance: Mitochondrial Inheritance; X-linked Recessive</p> <p>Molecular Basis of Inheritance - DNA;</p> <p>Cell Cycle - Mitosis; Meiosis; Nondisjunction</p> <p>Chromosomes; Autosomes and Sex Chromosomes</p>	<p>Mendelian Inheritance – Autosomal Recessive, Autosomal Dominant</p> <p>Atypical Mendelian Inheritance: Mitochondrial Inheritance; X-linked Recessive</p> <p>Molecular Basis of Inheritance - DNA;</p> <p>Cell Cycle - Mitosis; Meiosis; Nondisjunction</p> <p>Chromosomes; Autosomes and Sex Chromosomes</p>

<p>Karyotyping</p> <p>Indications for Performing a Chromosome Analysis</p> <p>Reasons for Analyzing Chromosomal Disorders</p> <p>Inherited and Non-Inherited Chromosome Abnormalities – Trisomy, Monosomy, Numerical Chromosome Abnormalities; Translocation, Deletion, Structural Chromosome Abnormalities, Sex Chromosome Abnormalities</p> <p>Mutations - Dynamic Mutation; Somatic Mutation; Point Mutation; Gene Deletion; Mutation Polymorphism</p> <p>Primer, Probe</p> <p>Genomic Imprinting</p> <p>Genetic Counselling</p> <p>General principles of endocrinology- Hormones and their release; Techniques for studying hormones-Immunoassays, The hypothalamic pituitary system, Thyroid hormones, Physiology of reproductive hormones, Hirsutism, Primary and secondary amenorrhea</p> <p>Hormonal regulation of spermatogenesis, testicular function and sex differentiation</p> <p>Hormonal regulation of ovarian cycles & luteal phase defect, implantation and pregnancy</p>	<p>Karyotyping</p> <p>Indications for Performing a Chromosome Analysis</p> <p>Reasons for Analyzing Chromosomal Disorders</p> <p>Inherited and Non-Inherited Chromosome Abnormalities – Trisomy, Monosomy, Numerical Chromosome Abnormalities; Translocation, Deletion, Structural Chromosome Abnormalities, Sex Chromosome Abnormalities</p> <p>Mutations - Dynamic Mutation; Somatic Mutation; Point Mutation; Gene Deletion; Mutation Polymorphism</p> <p>Primer, Probe</p> <p>Genomic Imprinting</p> <p>Genetic Counselling</p> <p>General principles of endocrinology- Hormones and their release; Techniques for studying hormones-Immunoassays, The hypothalamic pituitary system, Thyroid hormones, Physiology of reproductive hormones, Hirsutism, Primary and secondary amenorrhea</p> <p>Hormonal regulation of spermatogenesis, testicular function and sex differentiation</p> <p>Hormonal regulation of ovarian cycles & luteal phase defect, implantation and pregnancy</p>
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Paper 2 : Assisted Reproduction

2 Credits

Lecture (2 Credits 2 hours / week)

Existing	No changes
<p>History of assisted reproduction, Gonadotrophins, Ovarian reserve test: antral follicle count, CCCT, AMH test Ovulation induction, In Vitro Fertilization, Premature ovulation, Laparoscopy and Transvaginal ultrasound, Oocyte retrieval, variations of IVF: GIFT, ZIFT, Oocyte and embryo donation & third party reproduction, Surrogacy & Gestational carrier Agonist and Antagonist protocols, Stimulation protocols, individualized protocols, Complications of assisted reproduction; OHSS (Ovarian hyperstimulation syndrome), multiple pregnancy & complications, Fertility drugs and ovarian cancer, oocyte retrieval procedure, miscarriage, ectopic pregnancy, risks associated with ICSI Counselling in ART: Clinical, Embryological, Financial and Psychological counselling Sperm retrieval procedures: PESA/MESA, TESA/TESE Success in Assisted Reproduction, Data analysis, Reproductive tourism</p>	<p>History of assisted reproduction, Gonadotrophins, Ovarian reserve test: antral follicle count, CCCT, AMH test Ovulation induction, In Vitro Fertilization, Premature ovulation, Laparoscopy and Transvaginal ultrasound, Oocyte retrieval, variations of IVF: GIFT, ZIFT, Oocyte and embryo donation & third party reproduction, Surrogacy & Gestational carrier Agonist and Antagonist protocols, Stimulation protocols, individualized protocols, Complications of assisted reproduction; OHSS (Ovarian hyperstimulation syndrome), multiple pregnancy & complications, Fertility drugs and ovarian cancer, oocyte retrieval procedure, miscarriage, ectopic pregnancy, risks associated with ICSI Counselling in ART: Clinical, Embryological, Financial and Psychological counselling Sperm retrieval procedures: PESA/MESA, TESA/TESE Success in Assisted Reproduction, Data analysis, Reproductive tourism</p>

Semester 2

Clinical Embryology Techniques**8 credits**Practical 1 (8 Credits 16 hours / week)

Existing	No changes
<p>Conventional IVF; short & long coincubation, preparing for oocyte retrieval: Studying patient file, calculating the number of tubes and dishes for IVF and ICSI procedure, Labelling of dishes and tubes, adding culture media into the tubes and dishes, equilibration of culture dishes and tubes</p> <p>Day 1: Checking for equilibration of culture media, preparation of lab for oocyte retrieval, arranging necessary disposables in the laminar flow workstation, screening of follicular fluid, identification of oocyte cumulus complex, identification of granulosa cells, separation of cumulus oocyte complex and further culture of oocytes, assessment of fertilization, assessment of cleavage embryos, stage and grading of cleavage stage embryos, blastocyst culture and grading</p> <p>Embryo loading procedures and transfer techniques</p> <p>Embryology laboratory maintenance; data analysis and monitoring laboratory performance</p> <p>Trouble shooting in the laboratory</p>	<p>Conventional IVF; short & long coincubation, preparing for oocyte retrieval: Studying patient file, calculating the number of tubes and dishes for IVF and ICSI procedure, Labelling of dishes and tubes, adding culture media into the tubes and dishes, equilibration of culture dishes and tubes</p> <p>Day 1: Checking for equilibration of culture media, preparation of lab for oocyte retrieval, arranging necessary disposables in the laminar flow workstation, screening of follicular fluid, identification of oocyte cumulus complex, identification of granulosa cells, separation of cumulus oocyte complex and further culture of oocytes, assessment of fertilization, assessment of cleavage embryos, stage and grading of cleavage stage embryos, blastocyst culture and grading</p> <p>Embryo loading procedures and transfer techniques</p> <p>Embryology laboratory maintenance; data analysis and monitoring laboratory performance</p> <p>Trouble shooting in the laboratory</p>

Cryopreservation Techniques 8 credits**Cryopreservation Techniques 8 Credits**Practical II (8 Credits 16 hours / week)

Existing	No changes
<p>Preparation of cryopreservation solutions, selection of embryos for cryopreservation, setting up of dishes for vitrification & warming, selection of devices for vitrification, process of vitrification and warming, Trouble shooting in vitrification and warming, documentation of patient details and maintenance of patient records on embryos after warming, safety practice in vitrification, selection of blastocysts for vitrification, collapsing blastocoel for vitrification, method of blastocyst vitrification</p> <p>Vitrification of oocytes: preparation of dishes for vitrification, selection of devices for vitrification of oocytes, preparation of vitrification solutions for vitrification, process of oocyte vitrification</p> <p>Semen cryopreservation, cryoprotectants used, epididymal and testicular sperm cryopreservation</p> <p>Ovarian tissue cryopreservation: Harvesting ovary, preparation and processing of ovarian cortex, Vitrification of ovarian cortex, storage of vitrified ovarian cortex, warming of ovarian cortex.</p>	<p>Preparation of cryopreservation solutions, selection of embryos for cryopreservation, setting up of dishes for vitrification & warming, selection of devices for vitrification, process of vitrification and warming, Trouble shooting in vitrification and warming, documentation of patient details and maintenance of patient records on embryos after warming, safety practice in vitrification, selection of blastocysts for vitrification, collapsing blastocoel for vitrification, method of blastocyst vitrification</p> <p>Vitrification of oocytes: preparation of dishes for vitrification, selection of devices for vitrification of oocytes, preparation of vitrification solutions for vitrification, process of oocyte vitrification</p> <p>Semen cryopreservation, cryoprotectants used, epididymal and testicular sperm cryopreservation</p> <p>Ovarian tissue cryopreservation: Harvesting ovary, preparation and processing of ovarian cortex, Vitrification of ovarian cortex, storage of vitrified ovarian cortex, warming of ovarian cortex.</p>

Theory Paper 1: Research Methodology and Preimplantation Genetic Diagnosis**2 credits**Lecture (2 Credits 2 hours / week)

Existing	No changes
<p>Overview of research process and Research hypothesis</p> <p>Observational study designs, analysis of data and interpretation</p> <p>Process of conducting clinical trials</p> <p>Ethics and scientific conduct in human and animal research</p> <p>Literature search, systematic review and meta-analysis</p> <p>Publication process-Manuscript writing, selection of journal and uploading manuscript impact factor</p> <p>Statistics-variables in statistics, measures of central tendency and dispersions, data distributions, parametric and non-parametric tests, correlation and regression analysis, estimation of sample size, Chi-square test, t Test, P value</p> <p>Preimplantation genetics (PGD), overview, Indications; Sex linked disorders, Single gene defects, chromosomal disorders</p> <p>Technical of Biopsy procedures; Polar body biopsy; Cleavage-stage biopsy, Blastocyst biopsy, Cumulus cell analysis</p> <p>Genetic analysis techniques and diagnosis; FISH,,PCR-comparative genomic hybridization, Next generation sequencing, Preimplantation genetic haplotyping</p> <p>Implications of PGD, PGD and religion, Legal aspects in India and rest of the world</p> <p>PGS (pre-implantation genetic screening) and aneuploidy screening</p>	<p>Overview of research process and Research hypothesis</p> <p>Observational study designs, analysis of data and interpretation</p> <p>Process of conducting clinical trials</p> <p>Ethics and scientific conduct in human and animal research</p> <p>Literature search, systematic review and meta-analysis</p> <p>Publication process-Manuscript writing, selection of journal and uploading manuscript impact factor</p> <p>Statistics-variables in statistics, measures of central tendency and dispersions, data distributions, parametric and non-parametric tests, correlation and regression analysis, estimation of sample size, Chi-square test, t Test, P value</p> <p>Preimplantation genetics (PGD), overview, Indications; Sex linked disorders, Single gene defects, chromosomal disorders</p> <p>Technical of Biopsy procedures; Polar body biopsy; Cleavage-stage biopsy, Blastocyst biopsy, Cumulus cell analysis</p> <p>Genetic analysis techniques and diagnosis; FISH,,PCR-comparative genomic hybridization, Next generation sequencing, Preimplantation genetic haplotyping</p> <p>Implications of PGD, PGD and religion, Legal aspects in India and rest of the world</p> <p>PGS (pre-implantation genetic screening) and aneuploidy screening</p>

Theory Paper 2: Principles of Cryopreservation**2 credits**

Lecture (2 Credits 2 hours / week)

Existing	No changes
<p>History of cryopreservation, Principles of cryobiology; cryoprotectants, cryofreezers, Factors affecting freezing, cryopreservation protocols,</p> <p>Embryo cryopreservation; slow freezing and thawing method, penetrating and non-penetrating cryoprotectants, Slow freezing method for embryos,</p> <p>vitrification and warming of embryos,</p> <p>Cryoprotectants used in vitrification, Vitrification devices, Freeze all strategy, Importance of embryo cryopreservation</p> <p>Oocyte cryopreservation: history, indications, method of cryopreservation of mature and immature oocytes, current status of oocyte vitrification</p> <p>Fertility preservation; Ovarian tissue cryopreservation; history, current status, prospects, In vitro culture of ovarian tissue, Ovarian tissue transplantation and outcome</p> <p>Cryopreservation of semen and testicular tissue</p> <p>Storage of cryopreserved samples and its safety</p>	<p>History of cryopreservation, Principles of cryobiology; cryoprotectants, cryofreezers, Factors affecting freezing, cryopreservation protocols,</p> <p>Embryo cryopreservation; slow freezing and thawing method, penetrating and non-penetrating cryoprotectants, Slow freezing method for embryos,</p> <p>vitrification and warming of embryos,</p> <p>Cryoprotectants used in vitrification, Vitrification devices, Freeze all strategy, Importance of embryo cryopreservation</p> <p>Oocyte cryopreservation: history, indications, method of cryopreservation of mature and immature oocytes, current status of oocyte vitrification</p> <p>Fertility preservation; Ovarian tissue cryopreservation; history, current status, prospects, In vitro culture of ovarian tissue, Ovarian tissue transplantation and outcome</p> <p>Cryopreservation of semen and testicular tissue</p> <p>Storage of cryopreserved samples and its safety</p>

Practical Paper 1: Intracytoplasmic sperm Injection (ICSI)

8 credits

Practical (8 Credits 16 hours / week)

existing	No changes
<p>History of micromanipulation, Operation and maintenance of micromanipulation,</p> <p>Familiarization of different micromanipulators,</p> <p>Advantages and disadvantages of different micromanipulators, microtools: preparation and choice of microtools,</p>	<p>History of micromanipulation, Operation and maintenance of micromanipulation,</p> <p>Familiarization of different micromanipulators,</p> <p>Advantages and disadvantages of different micromanipulators, microtools: preparation and choice of microtools,</p>

Alignment of microtools and troubleshooting, preparation of dishes for micromanipulation, method of stopping sperm motility, method of aspiration of spermatozoa, method of holding oocyte, focusing oocyte and injection pipette, Method of intracytoplasmic sperm injection	Alignment of microtools and troubleshooting, preparation of dishes for micromanipulation, method of stopping sperm motility, method of aspiration of spermatozoa, method of holding oocyte, focusing oocyte and injection pipette, Method of intracytoplasmic sperm injection
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Practical Paper II: Micromanipulation and Embryo biopsy

8 credits

Practical (8 Credits 16 hours / week)

Existing	No changes
Assisted hatching; zona drilling, zona thinning, chemical and laser assisted hatching Biopsy procedures: Instrumentation, preparation of laboratory for biopsy procedure, method of biopsy, Acid Tyrode zona drilling, laser zona drilling, Biopsy of polar body, biopsy of blastomeres, trophoctoderm	Assisted hatching; zona drilling, zona thinning, chemical and laser assisted hatching Biopsy procedures: Instrumentation, preparation of laboratory for biopsy procedure, method of biopsy, Acid Tyrode zona drilling, laser zona drilling, Biopsy of polar body, biopsy of blastomeres, trophoctoderm

4 Semester

Theory Paper 1: New Developments in ART and embryonic stem cells

2 credits

Existing	Proposed changes
Stem cells and regenerative medicine; adult hemopoietic stem cells, testicular stem cells, embryonic stem cells, induced pluripotent Isolation of ICM (inner cell mass) and derivation of embryonic stem cells, preparation of mouse and human monolayer cells, Placental fibroblast cells, embryonic stem cell culture systems,	Stem cells and regenerative medicine; adult hemopoietic stem cells, testicular stem cells, embryonic stem cells, induced pluripotent stem cells Isolation of ICM (inner cell mass) and derivation of embryonic stem cells, preparation of mouse and human monolayer cells, Placental fibroblast cells, embryonic stem cell culture systems,

<p>identification of stem cell colonies, markers of stem cells, stem cell banking.</p> <p>Differentiation of stem cells, potential of stem cells in regenerative medicine, disease conditions stem cells investigated, disadvantages, current problems and future prospects</p> <p>Mitochondrial DNA mutations and diseases; Introduction</p> <p>Prevention of mitochondrial diseases and oocyte reconstruction; Pronuclear transfer technique, Spindle transfer technique, Ethics of oocyte reconstruction, current research</p> <p>Proteomics and metabolomics</p> <p>New embryo culture techniques</p> <p>Embryo editing</p> <p>Current and future developments</p>	<p>identification of stem cell colonies, markers of stem cells, stem cell banking.</p> <p>Differentiation of stem cells, potential of stem cells in regenerative medicine, disease conditions stem cells investigated, disadvantages, current problems and future prospects</p> <p>Mitochondrial DNA mutations and diseases; Introduction</p> <p>Prevention of mitochondrial diseases and oocyte reconstruction; Pronuclear transfer technique, Spindle transfer technique, Ethics of oocyte reconstruction, current research</p> <p>Proteomics and metabolomics</p> <p>New embryo culture techniques-Time Lapse embryo culture systems</p> <p>Embryo editing, Artificial intelligence in ART</p> <p>New stimulation protocols-dual stimulation, luteal phase stimulation, sperm vitrification, gametes from stem cells, non-invasive pre-implantation genetic testing, endometrial receptivity assay, endometrial rejuvenation,</p> <p>Current and future developments</p>
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Theory Paper 2: Regulation and Ethics in assisted reproduction.

2 credits

Existing	Proposed-No changes
<p>Moral philosophy</p> <p>Regulation in assisted reproduction- ICMR (Indian Council of Medical Research) guidelines and proposed ART bill, PCPNDT act, Surrogacy laws, Regulations of ART in other countries</p> <p>Regulation and ethics in clinical IVF practice; gamete and embryo donation, Research on embryos, sex selection, surrogacy, cloning; reproductive and therapeutic</p> <p>Regulation of gamete banks and gamete donors,</p>	<p>Moral philosophy</p> <p>Regulation in assisted reproduction- ICMR (Indian Council of Medical Research) guidelines and proposed ART bill, PCPNDT act, Surrogacy laws, Regulations of ART in other countries</p> <p>Regulation and ethics in clinical IVF practice; gamete and embryo donation, Research on embryos, sex selection, surrogacy, cloning; reproductive and therapeutic</p> <p>Regulation of gamete banks and gamete donors,</p>

Accreditation of ART centres and personnel, Counselling in ART, Ethics and regulations of embryo editing, Ethics of 3 parent baby, Ethics and regulations of PGD & PGT-A	Accreditation of ART centres and personnel, Counselling in ART, Ethics and regulations of embryo editing, Ethics of 3 parent baby, Ethics and regulations of PGD & PGT-A
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Research Seminar

4 credits

Existing	Proposed-No changes
Collection of information, Search engines (PubMed, gene data bank), Preparation of PPT. The student shall present a recently published research paper related to infertility and embryology through power point presentation	Collection of information, Search engines (PubMed, gene data bank), Preparation of PPT. The student shall present a recently published research paper related to infertility and embryology through power point presentation

Project work

10 Credits

Existing	Proposed-No changes
Project work is designed to provide research experience to the students. The student has to work independently on a research problem related to infertility. The student shall carry out this project in consultation with faculty.	Project work is designed to provide research experience to the students. The student has to work independently on a research problem related to infertility. The student shall carry out this project in consultation with faculty.