Resolution No. AC/II(23-24).2.RUS12

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for

Program: S.Y.B.Sc.

Program Code: (RUSMJZOO/RUSMIZOO)

(As per the guidelines of National Education Policy 2020-
Academic year 2024-25)

(Choice based Credit System)

GRADUATE ATTRIBUTES

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

GA	GA Description A student completing Bachelor's Degree in Science program will be able to:
GA 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
GA 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
GA 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
GA 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA 5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
GA 6	Apply scientific information with sensitivity to the values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
GA 7	Follow ethical practices at the workplace and be unbiased and critical in the interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
GA 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.

PROGRAM OUTCOMES

PO	Description **A student completing Bachelor's Degree in Science program in the subject of ZOOLOGY will be able to:**
PO 1	Identify the major groups of organisms, discuss the basis of their biodiversity, and draw parallels with their phylogenetic relationship, using well-thought cardinal features of classification on the basis of morphology and molecular information.
PO 2	Understand and analyse the evolutionary link amongst the animals and also understand the basic classification patterns of invertebrates and vertebrates. They will be able to compare and contrast the anatomy and physiology of different invertebrates and vertebrate phylum.
PO 3	Analyse the genes, genomes, cells, cell organelles, tissues and histological studies, understand the linkage of genes, mechanisms of sex determination, various structures of DNA and apply the knowledge of genetics to the process of evolution.
PO 4	Analyse and understand the broad concepts of ecology, food webs, food chains and the interconnectedness of biotic and abiotic factors. Comprehend the concepts of Population dynamics, communities and its dependence on the ecosystems.
PO 5	Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives.
PO 6	Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within Zoology.
PO 7	Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.

CREDIT STRUCTURE BSc

Semester	Subject 1		Subject 2	GE/ OE course (Across disciplines)	Vocational and Skill Enhancement Course (VSC) & SEC	Ability Enhancement Course/ VEC/IKS	OJT/FP/CEPCC, RP	Total Credits
	DSC	DSE						
1	4		4	4 (2*2)	VSC-2 + SEC -2	AEC- 2 (CSK) + VEC- 2 (Env Sc.) + IKS-2		22
2	4		4	4 (2*2)	VSC-2 + SEC-2	AEC-2 (CSK)+ VEC-2 (Understanding India)	CC-2	22
Total	8		8	8	8	10	2	44
Exit option: award of UG certificate in Major with 44 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								
3	Major 8		Minor 4	2	VSC-2	AEC-2 MIL	FP -2, CC-2	22
4	Major 8		Minor 4	2	SEC-2	AEC-2 MIL	CEP-2, CC-2	22
Total	16		8	4	4	4	8	44
Exit option: award of UG Diploma in Major with 88 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								
5	DSC 12	DSE 4	Minor 2		VSC-2		CEP/FP-2	22

6	**DSC 12**	**DS E 4**	**Minor 2**				**OJT-4**	**22**
Total	**24**	**8**	**4**		**2**		**6**	**44**
	Exit option: award of UG Degree in Major with 132 credits or Continue with Major for Honours/ Research							

Course Code: RUSMJZOOO201

Course Title: ZOOPHARMACOGNOSY AND PARASITOLOGY

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Analyse the method of self-medication and the application.
CO 2	Enumerate the concepts and practices of bioprospecting.
CO 3	Identify drugs of natural origin and their source.
CO 4	Explain the different concepts of parasitism, taxonomic diversity of parasites and their parasitic mode of life.
CO 5	Compare and state the differences of endoparasite and ectoparasite
CO 6	Enumerate the diagnosis and control of parasitic infections in humans and animals.

DETAILED SYLLABUS

Course code	Unit	Zoopharmacognosy and Parasitology	Credits/hours 3/45
RUSMJZOOO201	**Unit I**	**Zoopharmacognosy and Bioprospecting**	**1/15**
		Zoopharmacognosy ● Definition, history and types ● Self-medication and its mechanism ● Methods of self-medication through - Ingestion – ants and mammals, Geophagy – invertebrates and birds ● Absorption and adsorption ● Topical application – birds and mammals ● Applications of zoopharmacognosy - Social and trans generational zoopharmacognosy, Value to humans. **Bioprospecting** ● Traditional, modern bioprospecting ● Chemical prospecting ● Genetic prospecting ● Bionic prospecting ● Economic value and benefit sharing Bioprospecting and conservation, pros and cons of bioprospecting	
	Unit II	**Parasitology-I**	**1/15**
		Parasitology-I **Introduction to Parasitology** ● Definitions: parasitism, host, parasite, vector-biological and mechanical, Types of parasites- Ectoparasites, Endoparasite and their subtypes ● Types of hosts: intermediate and definitive, reservoir **Host-parasite relationship-Host specificity** ● Definition ● Structural specificity ● Physiological specificity and ecological specificity **Life cycle, pathogenicity, control measures and treatment** ● *Entamoeba histolytica* ● *Plasmodium vivax*	

		• *Trypanosoma gambiense* • *Fasciola hepatica* • *Taenia solium* • *Wuchereria bancrofti* • *Dracunculus medinensis* *Ascaris lumbricoides*	
	Unit III	**Parasitology II**	**1/15**
		Morphology, life cycle, pathogenicity, control measures and treatment • Head louse (*Pediculus humanuscapitis*) • Mite (*Sarcoptes scabiei*) • Bed bug (*Cimex lectularis*) • Mosquitoes • Housefly **Parasitological significance** • Zoonosis - Bird flu • Anthrax • Rabies • Toxoplasmosis Monocystis	
RUSMJZOOPO201		**PRACTICALS**	**Credits-01**
		Zoopharmacognosy and Parasitology	
1		Study of Zoopharmacognosy with reference to Chimpanzees, African Elephants, Wild Boars and Parrots.	
2		Study of Protozoan parasites: a) *Trypanosoma gambiense* b) *Giardia intestinanalis*	
3		Study of Helminth parasites: a) *Ancylostoma duodenale* b) *Dracunculus medenensis* *c) Wuchereria bancrofti*	
4		Parasitic adaptations: Scolex and mature proglottid of Tapeworm	
5		Study of Ectoparasites: a) Leech b) Tick c) Mite	
6		Mounting of fecal/rectal protozoans endoparasites from cockroaches (Balanthidium, nycthotherus, Entamoabe, nematodes etc)	

7		Study of Vectors: Mosquitoes (Anopheles, Culex and Aedes), Sand flea and Rat flea and Body Louse	
8		Mounting of *Monocystis* in the seminal vesicle of earthworm.	
9		Isolation and identification of parasite for the intestine of fish/chicken	
10		Study of larval stages of *Fasciola hepatica.* a) Miracidium b) Sporocyst c) Redia d) Cercaria e) Metacercaria	

References:

- Pharmacognosy and Pharmaco-biotechnology; Ashutosh Kar.
- Trease and Evans Pharmacognosy; Evans, W.C.
- Pharmacognosy; Kokate, C.K A and Purohit, A.P.
- Practical Pharmacognosy; Gokhale, S.B and Kokate, C.K.
- Text book of Pharmacognosy; T.E.Wallis.
- Biotechnology Fundamentals & Applications; S.S. Purohit.
- Chatterjee K.D.,Parasitology:(Protozoology and Helminthology), (2010), 13/e (6th reprint)Chatterjee Medical Publishers.
- Arora, Medical Parasitology, (2010), 3rd edition, CBS publishers.
- C.K JayaramPaniker, Textbook of Medical Parasitology, (2018), 8th edition, Jaypee Brothers.
- Kochhar S.K.,A text book of Parasitology- Dominant Pub. & Dis, New Delhi.
- Gerald and Schmidt,Essentials of Parasitology, (1990), 4th edition, Universal Bookstall, New Delhi.
- Sharma P.N.andRatnu L.N., Parasitology, (1984), Chand S &Co.Pvt.Ltd.
- Chandler and Read,Introduction to Parasitology, (1961), 10th edition, John Wiley & Sons

Course Code: RUSMJZOOO202/ RUSMIZOOO202

Course Title: LIFE PROCESSES

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOMES	After successful completion of this course, the student will be able to:
CO1	Describe different structures of digestive apparatus, respiratory apparatus, circulatory apparatus and reproductive systems of some invertebrates and vertebrates.
CO2	Explain the concept of seasonal and continuous breeders and give a comparative account.
CO3	Interrelate between the concept of increasing complexity of physiology of all life processes and its evolutionary hierarchy.
CO4	Compare and contrast between the integrating structure, function, and development of different systems amongst different phyla.
CO5	Correlate between the habit and habitat with the structures involved in all the physiologic processes in different classes of organisms
CO6	Draw diagrams of digestive systems, respiratory systems, circulatory systems of different invertebrate and vertebrate animals.

DETAILED SYLLABUS

Course code	Unit	Life Processes	Credits/hours 3/45
RUSMJZOOO202 / RUSMIZOOO202	**Unit I**	**Study of Nutrition and Excretion**	**1/15**
		Comparative study of Nutritional Apparatus with reference to feeding adaptations -Structure and functions: ● Invertebrates- eg: Amoeba, Hydra, Earthworm, Cockroach. ● Vertebrates-Fish ● Digestive system and physiology of digestion with respect to Man **Comparative Study of Excretory and Osmoregulatory systems of:** ● Amoeba - Contractile vacuoles ● Planaria -Flame cells ● Earthworm –Nephridia ● Cockroach-Malphigian tubules and green gland Structure of kidney, Uriniferous tubule and physiology of urine formation in Man.	
Unit II		**Study of Respiration and Circulation**	**1/15**
		Respiration ● Comparative study of Respiratory organs - Structure and Function with reference to Earthworm, Spider, Rohu. ● Accessory respiratory structures: *Anabas* or *Clarius* ● Structure of lungs and physiology of respiration in man. **Circulation** ● Comparative study of circulation: Open and closed - single and double ● Types of circulating fluids - Water, coelomic fluid, hemolymph, lymph and Blood Comparative study of Hearts (Structure and function) with reference to Cockroach, Shark and Human	
Unit III		**Control and coordination, Locomotion and reproduction**	**1/15**

		Control and co-ordination ● Irritability –*Paramecium*, Nervous system in Hydra and Earthworm ● Types of neurons on the basis of structure and function ● Conduction of nerve impulse: Resting potential, action potential and refractory period ● Synaptic transmission – Chemical and Electrical **Movement and Locomotion** ● Locomotory organs (Structures and Functions) - Pseudopodia in *Amoeba* (sol gel theory), Cilia in *Paramoecium* ● Tube feet in Starfish ● Fins of fish ● Structure of Striated, non-striated and cardiac muscle fibre in humans. **Reproduction** ● Asexual Reproduction- Fission, fragmentation, budding, gemmule formation ● Sexual reproduction – Gametogenesis ● Types of fertilisations -Self, cross, external and internal • Concept of oviparity, viviparity, ovo-viviparity	
RUSMJZOOPO202/ RUSMIZOOPO202		**PRACTICALS**	**Credits-01**
		Life Processes	
1		Hydra feeding-Tentacular feeding	
2		Feeding apparatus of Prawn and Sepia-Radula	
3		Study of nutritional Apparatus (Bivalves, Pigeon, Ruminant stomach)	
4		Urine analysis—Normal and abnormal constituents	
5		Detection of uric acid from excreta of Birds	
6		Detection of Creatinine in urine.	
7		Detection of ammonia in water excreted by fish	
8		Study of operculum movement of fish.	
9		Study of respiratory structures: a. Gills of Bony fish and Cartilaginous fish. b. Lungs of Frog	

		c. Lungs of Mammals d. Accessory respiratory structure in *Anabas* (Labyrinthine organ) a. Air sacs of Pigeon	
10		Study of hearts (Cockroach, Shark, Frog, *Calotes*, Mammal)	
11		Determination of blood sugar by GOD and POD method.	
12		Study of locomotory organs (*Amoeba*, Unio, Cockroach, Starfish, Fish, and Birds)	
13		Study of striated and non- striated muscle fibre.	
14		Study of different types of Reproduction a. Sponge gemmules b. Hydra budding c. T.S. of mammalian testis d. T.S. of mammalian ovary	

References:

- Jordan and Verma, Vertebrate Zoology Volume I, (2004), 2nd edition S. Chand and Co.
- Jordan and Verma, Invertebrate Zoology Volume II, (1963), S. Chand and Co.
- Majupuria T. C. ,Invertebrate Zoology, NaginS.and Co
- Dhami P. S. and Dhami J. K.,Chordate Zoology, (2014), R. Chand and Co.
- Dhami P. S. and Dhami J. K,Invertebrate Zoology., (2015) R. Chand and Co.
- Introduction to Invertebrates- Moore Cambridge University- Low Priced Edition.
- Miller S. A. and Harley J. B,Zoology., (2005), 6th edition, Tata McGraw Hill.
- Kotpal R. L., Modern Textbook of Zoology, Invertebrates, (2016), Rastogi Publication.
- Taylor D.J., Stout G.W., Green N. P. O, Soper R, BiologicalScience, Cambridge University Press.
- Guyton and Hall Textbook of Medical Physiology,12th edition, Saunders Elsevier.
- Taylor, Green and Stout,Biological Science, Cambridge Publication.
- E. P. Solomon, L. R. Berg, D. W. Martin,Biology, Thompson Brooks/Cole.
- Daniel D Chiras Jones and Bartlett, Human Biology.

Modality of Assessment

Discipline Specific Core Course (3 Credit Theory Course for BSc)

A) Internal Assessment- 40%- 30 Marks

Sr No	Evaluation type	Marks
1	Class Test	20
2	Project / Assignment / Presentation	10
	TOTAL	**30**

B) External Examination (Semester End)- 60%- 45 Marks

Semester End Theory Examination:

1. Duration – The duration for these examinations shall be of **One hour 30 Minutes**.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
1	A) (OR) A) (i and ii) B)	8 OR 8(4+4)+7= 15	UNIT 1
2	A) (OR) A) (i and ii) B)	8 OR 8(4+4)+7= 15	UNIT 2
3	A) (OR) A) (i and ii) B)	8 OR 8(4+4)+7= 15	UNIT 3
	TOTAL	**45**	

Practical Examination Pattern: Total Marks 25

A. **External Examination: 25 Marks**
Semester End Practical Examination:

Particulars	Practical
Major Experiment and/or Minor Experiment, Identification, Journal and *Viva voce*	25
Total	**25**

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / In charge of the department; failing which the student will not be allowed to appear for the practical examination.

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Course Title: Cytology and Genetics

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Describe the structure and function of cell.
CO 2	Distinguish between the characters of Prokaryotic and Eukaryotic cell.
CO 3	Describe various exceptions Mendel's fundamental law of inheritance and
CO 4	Explain Mendel's fundamental law of inheritance and its applications.
CO 5	Explain the cytological basis for variations, applications of genetics, sex determination, sex linked inheritance, gene expression and regulation.
CO 6	Solve problems based on inheritance.

DETAILED SYLLABUS

Course Code	Unit	Course Title - Cytology and Genetics	Credits/ Hours 3/45
RUSMJZOOE211	**Unit I**	**Introduction to cell biology** ● Definition and scope ● Cell theory ● Generalised prokaryotic, eukaryotic cell: size, shape, and structure. **Membrane structure and function** ● Fluid Mosaic Model ● Junctional complexes ● Membrane receptors ● Modifications: Microvilli, Desmosomes and Plasmodesmata **Structural organisation and function of intracellular organelles**: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, vacuoles, structure & function of cytoskeleton.	**1/15**
	Unit II	**Fundamental of genetics** ● **Definition, scope, and importance of genetics:** Classical and Modern concept of Gene (Cistron, muton, recon). ● **Brief explanation of the following terms:** Allele, wild type and mutant alleles, locus, dominant and recessive traits, homozygous and heterozygous, genotype and phenotype, genome. **Mendelian Genetics** ● Mendelian Genetics: Monohybrid cross, Dihybrid cross, test cross, back cross, Mendel's laws of Inheritance, Mendelian traits in man ● Exceptions to Mendelian Inheritance: Incomplete dominance, Codominance, Lethal alleles, Epistasis - Recessive, Double recessive, dominant and double dominant. ● Chromosome theory of inheritance	**1/15**

		● Pedigree analysis-Autosomal dominant and autosomal recessive, X-linked dominant, and X-linked recessive **Multiple Alleles and Multiple Genes** ● Concept of multiple alleles, Coat colour in rabbit, ABO and Rh blood group systems and its medico-legal importance. (Include case studies) ● Polygenic inheritance with reference to skin colour and eye colour in man. **Linkage and Crossing Over** ● Linkage: Definition, types, and significance ● Crossing over: Mechanism, types, significance, and cytological basis ● Concept of pleiotropy.	
	Unit III	**Chromosomes and Heredity** **Chromosomes** ● Introduction to morphology of chromosome, Chromosome structure- Heterochromatin, Euchromatin, Classification based on the position of centromere, Types of Chromosomes- Autosomes and Sex chromosomes ● Endomitosis, Giant chromosomes- Polytene and Lampbrush chromosomes and significance of Balbiani rings **Sex- determination** ● Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZW. ● Sex determination in honeybees- Haplodiploidy, ● Sex determination in Drosophila-Genic balance theory, intersex, ● Gynandromorphs. ● Parthenogenesis. ● Hormonal influence on sex determination- Freemartin and sex reversal. ● Role of environmental factors- *Bonellia*, *Crepidula fornicata*, Crocodile and Turtle. ● Lyon hypothesis and Barr bodies formation in mammals, Mechanisms of Dosage compensation in Drosophila and C. elegans **Sex linked, sex influenced and sex-limited inheritance** ● X-Linked: Colour blindness, Haemophilia	**1/15**

		● Y-linked: Hypertrichosis ● Sex-influenced genes and Sex-limited genes	

Practical

Course Code: RUSMJZOOPE211		
Sr. No.	**Practical Title- Cytology and Genetics**	**Credit: 1**
1.	Study of Polytene chromosome	
2.	Mounting of Barr bodies	
3.	Study of Mitosis by a temporary squash preparation of onion root tip.	
4	Study of Polyploidy in Garlic	
5.	Detection of blood groups and Rh factor	
6.	Problems in genetics – a) Monohybrid/ Dihybrid cross b) X linked inheritance c) Multiple alleles	
7.	Study of Chromosome morphology.	
8.	Maintenance of Drosophila culture, identify male and female flies, etherizing flies for transfer, identifying different larval stages (Activity based practical)	
9.	Study of permeability of cells through plasma membrane (Osmosis in blood cells).	
10.	Measurement of cell diameter by occulometer (by using permanent slide)	

Reference books

- Singh and Tomoar, Cell Biology, Rastogi Publication.
- E.D.P De Robertis and E.M.R Robertis, Cell and molecular Biology, CBS Publishers and Distributors.
- Goeffrey M. Coper, The cell A molecular Approach, ASM Press Washington D.C. ·
- Tyagi Suruchi, A textbook of cytology, Dominant Publishers and Distributors New Delhi.
- Gupta P.K and Pawar C. B., Cell Biology, Himalaya publication

- Insertus, Molecular Biology of the cell, (6th edition), Campbell Biology (9th edition)
- Gardner, E.J., Simmons, M.J and Snustad, D.P. John Wiley and Sons, Principles of Genetics, (1991), Jhon Wiley and Sons, New York.
- Klug, W.S., Cummings M.R., Spencer, C.A. Benjamin Cummings, Concepts of Genetics, 11th edition, (2014), Pearson.
- Russell, P. J, iGenetics- A Molecular Approach, (2009), 3rd edition, Benjamin Cummings publication.
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- Griffiths, A.J.F., Wessler. S.R., Lewontin, R.C. and Carroll, S.B., Introduction to Genetic Analysis, (2000), W. H. Freeman and Co.
- Verma P.S. and Agrawal P.K., Cell Biology, Genetics, Molecular Biology Evolution and Ecology, (2006), 9th edition, S. Chand Publication, New Delhi. .
- Eldon john Gardner, Michael J. Simmons, D. Peter Snustad, Principles of Genetics, (2006), Eight edition, Jhon Wiley and Sons
- Weaver, Hedrick, Genetics, (1996), third edition, McGraw Hill Education · Benjamin A. Pierce, Genetics A conceptual approach, (2016), 6th edition, Southwestern University, W.H. Freeman and company, New York
- Monroe W. Strickberger, Genetics, (2008), Third Edition, PHI Learning publication.
- Leland H. Hartwell, Leroy Hood, Michael L. Goldberg, Ann E. Reynolds, Lee M.Silver, Genetics from gene to genome, (2010), 4th edition, McGraw Hill Education

Course code: RUSMJZOOE212 / RUSMIZOOE212

Course Title: Comparative Embryology and Reproductive Biology

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Explain different types of eggs, patterns of cleavage, types of placentae and types of blastulae.
CO 2	Describe the concept of hormonal regulation of reproduction.
CO 3	Compare and correlate between the developmental process and type of animal.
CO 4	Distinguish between the reproductive systems of male and females and enumerate the impact of age on reproduction.
CO 5	Describe the causes of infertility related problems and concerned treatment
CO 6	Draw diagrams of male and female reproductive systems, structure of eggs, blastula and gastrula.

DETAILED SYLLABUS

Course Code	Unit	Course Title - Comparative Embryology and Reproductive Biology	Credits/ Hours 3/45
RUSMJZOOE212 / RUSMIZOOE212	**Unit I**	**Comparative Embryology** ● Types of Eggs-Based on amount and distribution of yolk ● Structure and Types of Sperms ● Types of Cleavage, Blastula and Gastrula ● Coelom–Formation and types ● Extra embryonic membranes ● Types of Placentae (Based on histology, morphology and implantation)	**1/15**
	Unit II	**Concepts of Human reproduction I** **Human Reproductive system and Hormonal regulation** ● Anatomy of human male and female reproductive system ● Hormonal regulation of Reproduction and Impact of age on reproduction ● Menopause and Andropause **Contraception & birth control** ● Difference between contraception and birth control ● Natural Methods: Abstinence, Rhythm method, Temperature method, ● Cervical mucus or Billings method, Coitus interruptus, Lactation amenorrhea ● Artificial methods: Barrier methods, Hormonal methods, Intrauterine contraceptives, Sterilisation, Termination, Abortion. **Infertility** **Female infertility -** ● Causes - Failure to ovulate, production of infertile eggs, damage to oviducts (oviduct scarring and PID or Pelvic inflammatory disease, TB of oviduct), Uterus (T. B. of uterus and cervix) ● Infertility associated disorders (Endometriosis, Polycystic Ovarian syndrome -(PCOS), POF (Primary ovarian failure), ● Antibodies to sperm, Genetic causes - Recurrent abortions. **Male infertility –**	**1/15**

		● Causes - Testicular failure, infections of epididymis, seminal vesicles or prostate, hypogonadism, cryptorchidism, congenital, Varicocele, Blockage, Azoospermia, Oligospermia, abnormal sperms, autoimmunity, ejaculatory disorders and Idiopathic infertility. **Common causes of infertility** ● STDs (Gonorrhea, Chlamydia, Syphilis and Genital Herpes), ● Endocrine disruptors	
	Unit III	**Concepts of Human reproduction II** **Diagnostic methods of male and female infertility** **Treatment of Infertility** ● Removal /reduction of causative environmental factors ● Surgical treatment ● Hormonal treatment and associated risks ● Sperm banks, cryopreservation of gametes and embryos ● Surrogacy ● In vitro fertilization, Embryo transfer (ET), Intra-fallopian transfer (IFT), Intrauterine transfer (IUT), Gamete intra-fallopian transfer (GIFT), intra-zygote transfer (ZIFT), Intracytoplasmic sperm injection (ICSI) with ejaculated sperm and sperm retrieved from testicular biopsies – Testicular sperm extraction ● Techniques and Ethical considerations of Artificial Reproductive Technology (ART) ● Coping and support needed in the process	**1/15**

Practical

Course Code: RUSMJZOOPE212 / RUSMIZOOPE212		
Sr. No.	**Practical Title- Comparative Embryology and Reproductive Biology**	**Credit: 1**
1.	Study of the types of placentae of rat, buffalo, goat and yolk sac of shark.	
2.	Study of extra embryonic membranes in chick.	
3.	Study of types of coeloms with respect to development.	
4	Fate Mapping Technique: Vital staining (Demonstration)	
5.	To study the developmental stages of Zebrafish embryos.	
6.	Study of the following permanent slides, museum specimens and materials. a. Mammalian sperm and ovum. b. Egg types –Fish, Frog, Hen. c. Cleavage, blastula and gastrula (Amphioxus, Fish, Frog and Bird)	
7.	Male and female reproductive system related diseases.	
8.	Pregnancy test	
9.	Study of fecundity of suitable fish and measurement of ova diameter.	
10.	Visit to IVF centre and report submission.	

References:

- Subramaniam T., Developmental Biology, Narosa Publishers.
- Berril N.J., Developmental Biology, Tata McGraw –Hill Publication.
- Martin H. Johnson, Essential Reproduction, Wiley-Blackwell Publication.
- Bradley M. Pattern, Chick Embryology.
- Mohan P. Arora, Embryology.
- Dalela, Verma and Tyagi, Chordate Embryology.
- E. L. Marieb, Human Anatomy and Physiology, Pearson Education Low Price Edition

- Taylor, Green and Stout, Biological Science, Cambridge Publication
- E. P. Solomon, L. R. Berg, D. W. Martin, Biology, Thompson Brooks/Cole
- Daniel D Chiras Jones and Bartlett, Human Biology
- E. K. Nobil and J. U. D. Neil, The Physiology of Reproduction Vol I & II, Raven Press, New York.

MODALITY OF ASSESSMENT

A] Internal assessment - 40% 30 marks

Sr. no.	Evaluation type	Marks
1.	One class test (Multiple choice questions or Objective)	20
2.	Assignment/ Case study/ Research project/ Group Discussion/ Presentation/ Viva	10
	TOTAL	**30**

B] External examination - 60% 45 marks

- Duration – These examinations shall be of **one and half hours** each paper.
- Paper Pattern: All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions Based on
1	A) (OR) A) (i and ii) B)	8 OR 8(4+4) + 7= 15	UNIT 1
2	A) (OR) A) (i and ii) B)	8 OR 8(4+4) + 7= 15	UNIT 2
3	A) (OR) A) (i and ii) B)	8 OR 8(4+4) + 7= 15	UNIT 3
	TOTAL	**45**	

C] Practical Examination Pattern: 25 marks

Semester end practical examination

Particulars	Practical
Lab work and / or *Viva voce* and / or Journal	25
Total	**25**

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.
In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / In charge of the department; failing which the student will not be allowed to appear for the practical examination.

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