ST. ALOYSIUS COLLEGE(AUTONOMOUS), JABALPUR

Reaccredited 'A+ +'Grade by NAAC(CGPA:3.58/4.00)
College with Potential for Excellence by UGC
DST-FIST Supported & STAR College Scheme by DBT

SchemeB-1 (For course of science Practical Discipline having Major Practicum Component)

Part A – Introduction

PROGRAMME: PG Diploma	Class: M.Sc.	2 Year/ III Semester	Session – 2026-27

Subject – Zoology

1	Course Code	CC-31 (Paper -1)
2	Course Title	Biology of gametes and its development.
3	Course Type	Core course
4	Pre – requisite (if any)	To study this course a student must have had one year PG diploma certificate or four year (Hon's/Hon's with research degree course.)
5	Course Learning Outcomes (CLO)	• To understand the structure, function, and molecular biology of gametes across different organisms. • To know the processes of gametogenesis (spermatogenesis and oogenesis) and the regulatory mechanisms involved. • To know the hormonal, genetic, and environmental factors influencing gamete development and fertility. • To know about stages of fertilization and early embryonic development. • To understand and application of modern techniques and experimental approaches to study gamete biology and reproductive technologies. • Understand the ethical, medical, and societal implications of assisted reproductive technologies. • Career opportunities in reproductive biology embryology, IVF technology, developmental genetics and fertility research in clinical and research settings.
6	Credit Value	06
7	Total Marks	Max. Marks: 60+40 =100 — Min. Passing Marks: 40

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Part B – Content of the Course		
Total No. of Lectures –Tutorials - Practical (in hour per week): 5 hour per week L-T-P		
Unit	Topics	No. of Lectures
I	**Gamete biology** • Gametogenesis and its structure. • Biochemistry of Semen: Semen composition and formation, assessment of sperm function. • Ovarian follicular growth and differentiation: morphology and endocrinology. • Molecular biology of oogenesis and vitellogenesis, ovulation and multiple ovulation and embryo transfer technology: invivo oocyte, maturation, superovulation elementary idea of IVF.	15
II	**Fertilization And Early Embryonic Development** • Recognition of Egg and Sperm: Capacitation, Acrosomal Reaction. Egg envelops and classification of eggs. • Mechanism of Fertilization in reference, to Sea Urchin and Mammals (Biochemistry of fertilization, Prefertilization, Postfertilization events). • Pattern of Cleavage, Morulation, Blastulation, Gastrulation & Morphogenetic movements. • Variation in gastrulation in Sea Urchin, Frog, Avian and Mammalian embryo. • Neurulation, Organogenesis of Eye, limb, Heart and Gonads.	20
III	**Late Embryonic Development** • Metamorphosis in Amphibians. • Axis specification in Drosophila: Role of maternal genes, patterning of early embryo by zygotic genes- gap genes, pair- rule genes, segment polarity genes. • Sex determination approaches in developmental biology. • The Stem Cell concept: Embryonic and adult stem cell, Disorders. • Embryonic and adult stem cell: Blood and lymphocyte lineages, haematopoiesis.	20
IV	• **Regeneration:** Epimorphic regeneration of salamander limb; Morphollaxis regeneration in hydra. • **Inborn errors of translation:** Teratogenesis environmental assaults on human development- Teratogenic agents like alcohol, retinoic acid etc. • **Postembryonic development:** Growth, cell proliferation, growth hormones; aging- genes involved in alteration in timing of sonescence. • **Programmed cell death:** Apoptosis, Autophagy and Necrosis. • **Garbha Sanskara - Epigenetics and Environmental Influence** Ancient Indian practices influencing foetal. and mental physical health: a) Music, mantra, maternal mood, diet, and lifestyle b) Parallels with epigenetic mechanisms (e.g., maternal stress DNA methylation)	20

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V	**Techniques, Ethical, Legal, and Social Issues (ELSI) in Development** • Gene knockout and gene knock-in (CRISPR-Cas9, TALENS, ZFNs), RNA interference (RNAi) and gene silencing in developmental studies. • Fate mapping and lineage tracing techniques. • Transgenesis and In situ hybridization in developmental tissues. • Ethics of human gene editing (CRISPR babies, Germline editing) • Intellectual property rights in genetic technologies. Public perception and misinformation about genetic interventions • Bioethical frameworks: Autonomy, justice, beneficence, non-maleficence.	15

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Part A – Introduction			
PROGRAMME: PG Diploma	Class:M.Sc.	2 Year/ III Semester	Session – 2026-27
Subject – Zoology			

1	Course Code	PC- 31 (Paper-1)	
2	Course Title	Biology of gametes and its development	
3	Course Type	Core course	
4	Pre – requisite (if any)	To study this course a student must have had One Year PG diploma certificate of Four year (Hon's/Hon's with research degree course .)	
5	Course Learning Outcomes (CLO)	• Demonstrate a clear understanding of the structure, development, and function of male and female gametes. • To Understand laboratory techniques for observing and analysing gametogenesis in model organisms. • To know of cellular and molecular mechanisms regulating gamete formation and maturation. • Understand the effects of environmental and genetic factors on gamete development through experimental observation.	
6	Credit Value	04	
7	Total Marks	Max. Marks: 60+40 =100	Min. Passing Marks: 40

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Part B – Content of the Course

Total No . of Lectures – Tutorials – Practical (in hour per week) : 3 hour per week

L-T-P

Unit	Topics	No. of Lectures
I	• Gametogenesis Study: Microscopic study of spermatogenesis and oogenesis using prepared slides. • Sperm Morphology and Motility: Collection and staining of sperm samples (e.g., fish, frog, or mammal). • Oocyte Maturation: Study of oocyte growth stages in amphibians (like Xenopus oocytes). • Gamete Viability Testing: Performing viability staining (e.g., Eosin - Nigrosin staining) to differentiate live and dead spermatozoa.	25
II	• Study of Fertilization Mechanisms: Demonstration (through Youtube and other online platform) of fertilization membrane formation in *sea urchin or starfish* eggs post-fertilization. • Hormonal Regulation of Gametogenesis (Demonstration through online platform like Youtube): Discussion or small experimental setups showing the effect of hormones (like FSH, LH) on gamete development (using model organisms or cell cultures).	25
III	• Cryopreservation Techniques: Introduction to methods of gamete cryopreservation (especially sperm freezing techniques). • Gamete Abnormalities: Study of morphological abnormalities in sperm cells under the microscope.	10

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Theory syllabus
Scheme A-1(For course of science Discipline having Major Practicum Component)

Part A - Introduction			
PROGRAMME : PG Degree	Class: M.Sc.	II Year/III Semester	Session- 2026-27

	Subject- Zoology	
1	Course Code	CC-32 (Paper-II)
2	Course Title	Animal physiology and Molecular Endocrinology
3	Course type	Core Course
4	Pre- requisite (if any)	To study this course a student must have had One Year PG diploma certificate or Four year (Hon's/Hon's with research degree course).
5	Course Learning Outcomes (CLO)	• Describe the structure and function of major organ systems (e.g., circulatory, respiratory, nervous, excretory, muscular, and digestive systems) across animal groups. • To Explain physiological mechanisms like homeostasis, nerve impulse transmission, muscle contraction, and thermoregulation. • Understand major endocrine glands (pituitary, thyroid, adrenal, pancreas, gonads) and understand their structure and hormonal functions and dis-function. • Understand the role of hormones in regulating processes like growth, metabolism, reproduction, and stress response. • careers in physiology research, endocrinology labs, biomedical sciences, pharmaceutical R&D, and hormone-based diagnostics and therapies.
6	Credit Value	06
7	Total Marks	Max. Marks: 60+40 / Min. Passing Marks: 40

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Part B - Content of the Course

Total No.of Lectures-Tutorials-Practical (in hour per week):3 hour per week L-T-P

Unit	Topics	No. of Lectures
I	**Tridosha System and Physiological Functions** • Vata: Nervous system & locomotion • Pitta: Metabolism & thermoregulation • Kapha: Structure & stability **Introduction To Digestion, Respiration And Excretion Systems:** • Definition, Divisions of physiology, Relationship of physiology with other sciences, Significance of the study. • Digestive system in man, Physiology of digestion, Absorption and Assimilation, Gastrointestinal hormones and their control in digestion. • Respiratory system in Human, Types and mechanism of respiration-Transportation of gases, Control of respiration. • Excretory system of human, Structure and functions of nephron, Urine formation and its regulation.	18
II	**Cardio vascular system and nervous system:** • Blood: Composition, Haemopoiesis, formed elements, Blood volume and its regulation, Haemostasis. • Types of heart, Structure of human heart, Heart beat and Cardiac cycle, Blood pressure, ECR and its application. • Types and functions of neurons, Central and Peripheral Nervous System, Synapse and its transmission, Resting and action potential, Neuro-muscular junction.	16
III	**Effectors And Receptors:** • General structure and types of muscles, Sarcomere, Ultra structure of skeletal muscle, Mechanisms of muscle contraction, Chemical changes during muscle contraction, Kymograph. • Physiology of vision, hearing and tactile response. • Thermoregulation in animals. Tolerance to high temperature, cold and freezing, Physiology of hibernation and aestivation. • Osmo-ionic regulation in freshwater and marine fishes and crustaceans Response to hyper and hypo-osmotic media. Adaptation to pressure in high altitude - Buoyancy.	18
IV	**Molecular Endocrinology** • Basic concept of endocrinology, discovery of hormones as chemical signals for regulation of physiological processes. • Evolution of chemical communication in animal systems and its classification. • Structure of peptide and protein hormones: Storage and secretion of hormones, molecular mechanisms of regulation. Transcriptional and post transcriptional mechanisms of hormone biosynthesis and secretion.	20

	• Phylogenic analysis of hormonal structures and functions. • Inhibitors of hormone biosynthesis and their use.	
V	**Nature of hormonal effects and actions:** • Discovery of receptors in target tissues. Mechanisms of hormone action and signal attenuation. Signal discrimination, signal transduction and signal amplification in hormone regulated physiological processes. • Structural requirements for successful hormone-receptor interactions. Receptor antagonists and their applications. • Metabolism of hormones by target and non-target tissues. of hormones. • Hormones and behaviour- cellular and molecular actions of semiochemicals.	18

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Practical syllabus

Scheme A-1(For course of science Discipline having Major Practicum Component)

Part A - Introduction			
PROGRAMME : PG Diploma	Class: M.Sc.	II Year/IIISemester	**Session** 2026-2027

	Subject- Zoology	
1	Course Code	PC-32 (Paper-II)
2	Course Title	Animal physiology and Molecular Endocrinology
3	Course type	Core Course
4	Pre- requisite (if any)	To study this course a student must have had One Year PG diploma certificate or Four year (Hon's/Hon's with research degree course).
5	Course Learning Outcomes (CLO)	• Understand and apply basic experimental techniques used in animal physiology • Identify major histological structures and correlate structure to function through microscopic studies. • Analyze hormone functions and mechanisms by Demonstrate understanding of hormone production, secretion, and receptor-mediated actions through practical experiments and virtual labs. • Evaluate the effects of hormonal and neural control in maintaining homeostasis (thermoregulation, osmoregulation, metabolic regulation).
6	Credit Value	04
7	Total Marks	Max. Marks: 60+40 | Min. Passing Marks: 40

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Part B – Content of the Course

Total No. of Lectures – Tutorials – Practical (in hour per week): 3 hour per week

L-T-P

Unit	Topics	No. of Lectu
I	• Digestive System: Study of digestive enzymes: Amylase, Pepsin, Trypsin activity experiments. • Study of human alimentary canal (model/chart/dissection of goat/rat stomach if permitted). • Qualitative tests for digestion products (glucose, fatty acids, amino acids). • Measurement of lung volumes and capacities using a *spirometer*. • Study of the structure of human respiratory organs (models/charts). • Microscopic study of kidney (histology slides) - cortex, medulla, nephron.	25
II	• Estimation of haemoglobin content using Sahli's method. • Measurement of blood pressure using sphygmomanometer. • Recording of heart sounds (demonstration of stethoscope use). • Study of human heart model and cardiac cycle stages (with charts/models).	15
III	• Microscopic study of muscle types (skeletal, smooth, cardiac muscle slides). • Thermoregulation and Osmoregulation: Study of behavioral responses to temperature (earthworm/fish models if available). • Study of hormone assays (like ELISA for insulin demonstration if feasible) • Histological study of endocrine glands (thyroid, pancreas, adrenal slides).	20

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