

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS) KUMBAKONAM

(Curriculum – M.Sc., Zoology– 2023–2024)

Department :Zoology

2024 - 2025
Programme Code: PSZO

SEMESTER – I

Part	Course type	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						CIA	ESE	Total
Part-I	CC- I	Structure and functions of Invertebrates	6	5	3	25	75	100
	CC – II	Comparative Anatomy of Vertebrates	6	5	3	25	75	100
	CC – III	Laboratory Techniques in Zoology I - Practical	6	5	3	40	60	100
	EC - I	1. Entomology 2. Tools and Techniques in Biology	5	3	3	25	75	100
	EC - II	1. Reproductive Endocrinology 2. Aquaculture	5	3	3	25	75	100
Part II	SEC- I	Animal Behaviour	2	1	3	25	75	100
		Total	30	22				600

SEMESTER – II

Part	Course type	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						CIA	ESE	Total
Part-I	CC- IV	Cellular and Molecular Biology	6	5	3	25	75	100
	CC – V	Genetics	6	5	3	25	75	100
	CC – VI	Laboratory Techniques in Zoology II - Practical	6	5	3	40	60	100
	EC - III	1. Nanotechnology 2. Microbiology and Immunology	5	3	3	25	75	100
	EC - IV	1. Biotechnology and Bioinformatics 2. Basic Medical Knowledge	5	3	3	25	75	100
Part II	SEC- II	Apiculture	2	1	3	25	75	100
	ECC - I	Moocs/Swayam Courses	-	2/3	-	-	-	-
		Internship / Industrial training*	--	--	--	--	--	--
		Total	30	22				600

*Internship/industrial training during summer vacation. The credits shall be awarded in semester III statement of marks.

SEMESTER – III

Part	Course type	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						CIA	ESE	Total
Part-I	CC- VII	Developmental Biology and Evolution	6	5	3	25	75	100
	CC-VIII	Animal Physiology	6	5	3	25	75	100
	CC – IX	Biostatistics and Research Methodology	6	5	3	25	75	100
	CC - X	Laboratory Techniques in Zoology – III - Practical	6	5	3	40	60	100
	EC - V	1. Medical Laboratory Techniques 2. Dairy Science	4	3	3	25	75	100
Part II	SEC- III	Diet for Healthy Life	2	1	3	25	75	100
	ECC – II	Moocs/Swayam Courses	-	2/3	-	-	-	-
	ECC -III	General Studies for Research Fellowship and Lecturership	-	2	3	-	-	100
	AEC	Internship / Industrial training*	--	2	--	--	--	--
		Total	30	26				600

SEMESTER – IV

Part	Course type	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						CIA	ESE	Total
Part-I	CC- XI	Ecology and Ethology	6	5	3	25	75	100
	CC – XII	Laboratory techniques in Zoology- IV - Practical	6	3	3	25	75	100
	CC – XIII	Project with viva voce	8	5	3	20	80	100
	EC - VI	1. Bioinstrumentation 2. Stem Cell Culture	5	3	3	25	75	100
Part II	AEC – II	Life Sciences for SET/CSIR Examination	5	2	3	25	75	100
	EA	Extension Activity	-	2	-	-	-	100
		Total	30	22				600

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-I CORE COURSE - I

CODE: P23ZC101 STRUCTURE AND FUNCTION OF INVERTEBRATES

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course Contents

UNIT I:

Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy.

UNIT II:

Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates; Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata

UNIT III:

Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan; Filter feeding in Polychaeta, Mollusca and Echinodermata. Respiration: Organs of respiration: Gills, lungs and trachea; Respiratory pigments; Mechanism of respiration.

UNIT IV:

Excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malpighian tubules; Mechanisms of excretion; Excretion and osmoregulation. Nervous system: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda); Trends in neural evolution.

UNIT V:

Invertebrate larvae: Larval forms of free living in vertebrates - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Chaetognatha, Rotifera and Phoronida. Concept and significance; Organization and general characters

Text Books:

Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.

Books for reference:

1. Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.
2. Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. 2013. The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.
3. Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited. pp-624.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	K1
CO2	Understand the evolutionary process that all are linked in a sequence of life patterns.	K2
CO3	Apply this for pre-professional work in agriculture and conservation of life forms.	K3
CO4	Analyze what lies beyond our present knowledge of life process.	K4
CO5	Evaluate and create the perfect phylogenetic relationship in classification.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	2		
CO2	3	3	2	2	2		
CO3	2	3	3	3	3	1	
CO4	2	3	2	2	1		
CO5	3	3	1	2			
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (6X5=25)	1 question from each unit (3*10=30)

John Jay
03/10/2024

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DEPARTMENT OF ZOOLOGY
M.Sc., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-I ELECTIVE COURSE - I

CODE: P23ZCE1:1

ENTOMOLOGY

PZDEL:1

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT I:

Overview of insects and insect taxonomy: Insects and their biological success - Man and insects; Basic concepts in Insect Taxonomy and classification.

UNIT II:

Beneficial insects: Silkworms - types, life history, disease management and rearing methods - Types of honey bees, life history, social organization (colonies and caste system), honey bee care and management of bee hive - Lac insects-life history, lac cultivation; Pollinators, predators, parasitoids, scavengers, weed killers, soil-builders.

UNIT III:

Destructive insects: Insect pests - definition - Categories of pests - Types of damage to plants by insects - Causes of pest outbreak - Economic threshold level - Biology of the insect pests - Pests of paddy, cotton, sugarcane, vegetables, coconut and stored grains cereals.

UNIT IV:

Pest management/Control strategies: Methods and principles of pest control - Natural control, Artificial control, Merits and demerits or limitations of these methods in pest control - Development and uses of pest resistant plant varieties - Integrated pest management - Concepts and practice.

UNIT V:

Vector biology: Vectors of veterinary and public health importance - Mosquitoes as potential vectors of human diseases-control measures

Text Books:

I. Ayyar, L.V. R. 1936. Hand book of Economic Entomology for South India
Narendra Publishing House. New Delhi, pp- 528.

Books for reference:

Vasantharaj David, B. and V.V. Ramamurthy. 2016. Elements of Economic Entomology, Eighth Edition, Brillion Publishing, New York, pp-400.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Remember the taxonomy of insects	K1
CO2	Gain knowledge on different types, mouth parts in insects, their physiology, and reproductive cycles that enable them to select appropriate pest control strategies.	K2
CO3	Acquire knowledge of medical entomology	K3
CO4	Apply knowledge of agricultural pest management	K4
CO5	Create strategies for integrated pest management	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	1	3	1	2	
CO2	3	3	3	3	1		
CO3	3	3	3	3	1	1	
CO4	3	3	3	3	1	1	
CO5	3	3	3	3	1	1	
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (5*5=25)	1 question from each unit (3*10=30)

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SEMESTER-I ELECTIVE COURSE-II

CODE: PZDE1:4

AQUACULTURE

PZDE1:4

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT I: Importance of aquaculture- Present status, prospects and scope in India. Freshwater aquaculture- Brackishwater aquaculture- Mariculture - Metahaline culture in India. Types of fish culture -Types of fish ponds for culture practice. Topography, site selection - water quality - soil condition and quality - structure and construction design and layout - inlet and outlet. Water quality management for aquaculture. Control of parasites, predators and weeds in culture ponds. Fish farm implements - Secchi disc - aerator - pH meter - tools for hypophysation - feeding trays - Fishing gears used in aqua farming.

UNIT II: Procurement of seed from natural resources- collection methods and segregation. Hatchery technology for major carps and freshwater prawn. Artificial seed production -Breeding under control conditions, induced breeding technique, larval rearing, packing and transportation. Commercial substitute for pituitary extracts. Classification of fish feed- Artificial feeds Types, Feed - formulation - feeding methods. Live feed- Microalgae, Rotifer, Artemia and their culture.

UNIT III: Shrimp hatchery technology - Hatchery design, brood stock management, spawning, larval rearing, Shrimp developmental stages, algal culture, packing and transportation. Shrimp culture technology - extensive culture methods semi- intensive - intensive culture methods - Biofloc technology - Culture operations (water quality, feed and health management) - harvesting, preservation and marketing. Brackish water fish culture. Edible and Pearl oyster culture - pearl production. Crab culture. Economic importance of Lobster, Sea urchin and Sea cucumber - their by-products. Types of Seaweeds - species and methods of culture - by-products

UNIT IV: Fish and Shrimp diseases and health management - infectious diseases - Bacterial, Fungal, Viral, Protozoan; Non-infectious - environmental and nutritional diseases. Diseases diagnosis, prevention and control measures.

UNIT V: Types of ornamental fishes (freshwater and marine), their breeding behavior and biology. Oviparous, Ovo-viviparous and Viviparous fishes. Setting and maintenance of freshwater Aquarium tanks. Central aquaculture research organizations- CMFRI, CIBA, CIFT, CIFA, CIFE, MPEDA and its activities.

Text Books:

1. Pillay, T. V. R. (1990). Aquaculture: Principles and Practices. Blackwell Scientific Publications Ltd.
2. Santhanam, R. (1990). Fisheries Science. Daya Publishing House.
3. Sinha, V.R. P. and Srinivastava, H. C. (1991). Aquaculture Productivity. Oxford and IBH Publications CO., Ltd., New Delhi.

Books for reference:

1. Das M. C. and Patnaik, P. N. (1994) Brackish water culture. Palani paramount Publications, Palani, T. N.
2. Day, F (1958). Fishes of India, Vol I and Vol. II. William Sawson and Sons Ltd., London.
3. Jhingran, V. G. (1991). Fish and Fisheries of India. Hindustan Publishing Co., India

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	To acquire knowledge about the importance of aquaculture.	K1
CO2	To understand the different types of culture and pond management.	K2
CO3	To apply knowledge about cultivable species and aquarium keeping for commercial purposes	K3
CO4	To devise methods for farm maintenance.	K4
CO5	To integrate and utilize the organizations and funding agencies involved in aquaculture.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	4	3	3	2	2	
CO2	3	4	3	3	2	2	2
CO3	3	4	3	3	2	2	2
CO4	4	3	3	2	1	2	3
CO5	4	3	4	3	2	1	2
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (5*5=25)	1 question from each unit (3*10=30)

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SEMESTER-I SEC-I

CODE: P23Z1SE1

ANIMAL BEHAVIOUR

PZ1SE1

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	2	-	-	1	25	75	100

Course Contents

UNIT I:

Scope and importance of animal behavior classification of behavioral patterns; Innate Behavior – Types, Fixed Action Pattern – FAP in male stickle back fish, Greylag goose, newborn babies, Mason wasp, Taxes, Reflex.

UNIT II:

Learned Behavior – Associative learning, Insight learning, Imprinting, Habituation

UNIT III:

Social behavior – Aggression, territoriality, Altruism; Reproductive Behavior – Courtship, mating and parental care.

UNIT IV:

Migration – Patterns, Types, Causes, navigation, Orientation, Advantages & Disadvantages of migration.

UNIT V:

Biological Rhythms – Circadian, Circatidal, Circalunar, Semilunar and Circannual rhythms.

Text Books:

1. Dr. P. Natarajan and Dr. N. Arumugam (2018), Animal Behaviour, Saras Publication
2. Dr. V. K. Agarwal, Animal Behaviour (2009), S. Chand and Company Pvt. Ltd, New Delhi.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	To acquire knowledge about the animal behavior patterns	
CO2	To understand about the learned behaviour	
CO3	To explain the characteristics of social behaviour	
CO4	To gain knowledge about the migration	
CO5	To acquire knowledge on biological rhythms	

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	3	3	3	3	2	2
CO2	3	4	4	4	2	1	2
CO3	4	3	3	4	3	2	3
CO4	4	3	4	3	2	2	3
CO5	3	4	3	3	3	2	3
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern

Section A

1 (a & b) question from each unit
(5x15=75)

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SEMESTER-I CORE COURSE-III
CODE: P23ZC103P LABORATORY TECHNIQUES IN ZOOLOGY-I

PRACTICAL

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Practical	6	-	-	5	40	60	100

Course Contents

INVERTEBRATES

Dissection: Earthworm: Nervous system; *Pila*: Digestive and nervous systems
Cockroach: Nervous system; Prawn: Appendages, nervous and digestive systems
Study of the following slides with special reference to their salient features and their modes of life

1. *Amoeba* 2. *Entamoeba histolytica* 3. *Paramecium*
4. *Hydra* with bud 5. Sporocyst – Liver fluke 6. *Cercaria* larva
7. Tape worm (*Scolex*) 8. *Ascaris* T. S. 9. Mysis of prawn

Spotters

1. Scorpion 2. *Penaeus indicus*
3. *Emerita* (*Hippa*) 4. *Pernaviridis*

Mounting

Earthworm : Body setae; *Pila* : Radula
Cockroach : Mouth parts; Grasshopper : Mouth parts

CHORDATES Study the nervous system of Indian dog shark - Dissection

1. Nervous system of *Scoliodon laticaudatus* – 5th or Trigeminal nerve
2. Nervous system of *Scoliodon laticaudatus* – 7th or Facial nerve
3. Nervous system of *Scoliodon laticaudatus* – 9th and 10th or Glossopharyngeal & Vagus nerve

Study of the following specimens with special reference to their salient features and their modes of life

1. *Amphioxus* sp. (Lancelet) 2. *Ascidia* sp. (sea squirt)
3. *Scoliodon laticaudatus* (Indian dog shark) 4. *Trygon* sp. (Sting ray)
5. *Torpedo* sp. (Electric ray) 6. *Arius maculatus* (Cat fish)
7. *Belonecancila* (Flute fish) 8. *Exocoetuspoeilopterus* (Flying fish)
9. *Mugilcephalus* (Mullet) 10. *Tilapia mossambicus* (Tilapia)
11. *Rachycentron canadum* (Cobia) 12. *Tetrodon punctatus* (Puffer fish)
13. *Dendrophis* sp. (Tree snake)

Study of the different types of scales in fishes

1. Cycloid scale 2. Ctenoid scale 3. Placoid scale

Study of the frog skeleton system (Representative samples)

1. Entire skeleton 2. Skull 3. Hyoid apparatus
4. Pectoral girdle and sternum 5. Pelvic girdle
6. Fore limb 7. Hind limb

Mounting: Weberian ossicles of fish.

1 or 2 Major/ Minor/ Spotter excises will be added in accordance with selection of Elective courses

Text Books:

2. Lal, S.S. 2009. Practical Zoology, Rastogi Publications, pp-484.
3. Iulius G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. Academic Press, Imprint of Elsevier Publication, pp-416.
4. Verma, P.S. 2000. Manual of Practical Zoology: Chordates, S. Chand Publishing Company, pp-528

Books for reference:

1. Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International Publication.
2. Sinha, J., A. K. Chatterjee, P. Chattopadhyaya. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Learn the adaptive features of different groups of animals	K1
CO2	Understand the structure and functions of various systems in animals	K2
CO3	Demonstrate the dissection and mounting techniques	K3
CO4	Analyse the salient features and the modes of life of invertebrates and chordates	K4
CO5	Examine the external morphology and classify the organisms with justification.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	1			
CO2	3	3	1	2	1		1
CO3	3	3	1	3	1		3
CO4	2	3	2	1			
CO5	2	2	2	1		1	1
Weightage							
Weighted% of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern: (Internal 40+External 60=100)

Section A	Section C	Section C
1 X 20 = 20	2X 10 = 20	Record = 5 Spotters = 10 Viva = 05

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OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-I ELECTIVE COURSE - II

CODE: P23ZDEI:3 REPRODUCTIVE ENDOCRINOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT – I General endocrinology: Structure of endocrine glands - secretion of pituitary, thyroid, pancreas, adrenal, ovary and testis – factors influencing secretion – endocrine disorders.

UNIT- II Male reproductive system: Testis – structure, spermatogenesis, spermiogenesis, steroidogenesis, endocrine, paracrine and autocrine regulation. Epididymis: structure and function and regulation. Accessory sex organs – prostate, seminal vesicles, bulbo urethral gland - structure, function and regulation.

UNIT- III Ovary: Structure, folliculogenesis, ovulation – Sources of ovarian hormones, ovarian androgen, inhibit – endocrine regulation of ovarine – functions. Uterus and fallopian tube – Structure, function and hormonal regulation, reproductive cycles. Mammary gland - Structure, function and regulation

UNIT –IV Conception: Fertilization, conception, parturition, maternal-foetal placental hormones.

UNIT – V Sterility: Male and female sterility – regulation of male and female fertility – surgical method – hormonal and non-hormonal methods.

Text Books:

1. Turner C.D. (1966). General endocrinology. 4th Ed., W.B.Saunders Co., London. 2. Barrington E.J.W. (1968). An introduction to general and comparative endocrinology. Academic press, London. 3. Bentley P.J. (1985). Comparative vertebrate endocrinology. S.Chand and Co., Newyork.

Books for reference:

1. Barrington (1979). Hormones and evolution, Vol.I&II, Academic press, Newyork. 2. Wiliaimas R.H. (1974). Text book of endocrinology V.Ed. Saunders Press, London. 3. E.K. Nobil and JU. D. Neil (1988). The physiology of reproduction V. I& II E.K.Nobil and JU. D. Neil, Raven press, Newyork.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Explain the structure and functions of reproductive glands	K1
CO2	Understand the regulation of testis, epididymis and accessory glands by hormone	K2
CO3	Correlate the structure, function and regulation of ovary, uterus, fallopian tube and mammary gland.	K3
CO4	Know the biological process of fertilization, conception and parturition	K4
CO5	Analyse and understand the reasons for male and female sterility and fertility	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	1		1
CO2	2	3	2	2	2		2
CO3	3	2	3	2	2		1
CO4	2	3	2	3	1		1
CO5	3	2	2	3			1
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (5*5=25)
		1 question from each unit (3*10=30)

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PZC 204

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M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-II CORE COURSE - IV

CODE: CELLULAR AND MOLECULAR BIOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course Contents

UNIT I:

Uniqueness of eukaryotic cells - Protoplasm and deutoplasm - cell theory; Diversity of cell size and shapes. Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, centrioles.

UNIT II:

Cellular organization: Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane proteins diffusion, osmosis, ion channels, active transport, ion pumps, bulk transport. mechanism and regulation of intracellular transport, electrical properties of membranes.

UNIT III:

Cell division and Cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Molecular biology of cell: Structure of DNA and RNA; Process of DNA replication, transcription and translation process; Genetic code.

UNIT IV:

Cell communication and cell signaling: Types of signalling, Stages of cell signalling, Types of receptors-Intracellular and membrane bound (G protein linked, Tyrosine kinases and gated ion channels)-Second messengers- (cAMP, calcium ions and inositol phosphate) Signalling pathways of G protein linked receptors with cAMP as second messenger -Extracellular space and matrix-Intercellular junction and their role in cell communication.

UNIT V:

Cancer cells: Characteristic features of normal and cancer cells; Carcinogens: types and cancer induction; Metastasis; Oncogenes and tumor suppressor genes, apoptosis; therapeutic interventions of uncontrolled cell growth.

Text Books:

1. Plopper, G., D. Sharp, and E. Sikorski. 2015. Lewin's Cells (Third Edition), Jones & Bartlett, New Delhi, pp-1056.
2. Plopper, G. 2013. Principles of Cell Biology, Jones & Bartlett, Maryland, pp-510.

Books for reference:

- (1) Lodish, H., C. A. Kaiser, A. Bretscher, *et al.*, 2013. Molecular Cell Biology (Seventh Edition), Macmillan, England, pp-1154
- (2) De Robertis, E.D.P. and E. M. F. De Robertis Jr, 1987. Cell and Molecular Biology. Info-Med, Hong Kong, pp-734.
- (3) Abbas, A. K., A. H. Lichtman and S. Pillai, 2007. Cell and Molecular Immunology (Sixth Edition), Saunders, Philadelphia, pp-566
- (4) Loewy, A.G., P. Sickevitz and J. R. Menninger, *et al.*, 1991, Cell Structure and Function (Third Edition), Saunders, Philadelphia, pp-947

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Visualize and remember the basic molecular processes in prokaryotic and eukaryotic cells, especially relevance of molecular and cellular structures influencing functional features.	K1
CO2	Understand the general concepts of cell and molecular biology.	K2
CO3	Relate the concepts of cell cycle and cell division regulation and carcinogenesis.	K3
CO4	Perceive and analyse the importance of physical and chemical signals at the molecular level resulting in modulation of response of cellular responses.	K4
CO5	Update the knowledge on the rapid advances in cell and molecular biology for a better understanding of onset of various diseases including cancer and to find novel therapeutic measures	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2			1
CO2	2	3	3	2	2		2
CO3	2	3	3	3	2		1
CO4	3	2	3	2	2		1
CO5	3	3	3	3	1		2
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern: Maximum = 75 Marks

Section A		Section B	Section C
2 Multiple choice questions from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (5X5=25)	1 question from each unit (3*10=30)

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PZC205
GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-II CORE COURSE - V

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course Contents

UNIT I:

Classical genetics: Mendel's law - Gene interaction: Codominance, Supplementary, Complementary, Epistasis - Dominant, Pleiotrophism, Penetrance, Expressivity - Sex linked Inheritance, Sex influenced genes, Sex limited genes- Genomic imprinting, X inactivation in mammals.

UNIT II:

Allele- Multiple Alleles: ABO Blood grouping - Pseudo allele, Linkage and Crossing over - Mechanism and Chromosomal mapping. Homologous recombination- Holiday model, Non - Homologous Recombination. Fine structure of gene - cistron, muton, recon, exon and split genes. House keeping genes, luxury genes.

UNIT III:

Sex determination: Grasshopper, Bonellia, Free-martin (Cattle), Pigeon, Sacculina. Extra nuclear inheritance by cellular organelles - Mitochondria and Chloroplast. Microbial Genetics: Methods of gene transfer: Transformation, conjugation, sex-duction and transduction.

UNIT IV:

Mutation: Reversible and irreversible mutation, types of mutation, Factors cause mutation, Molecular basis of mutation. DNA repair, types of DNA repair - molecular mechanism of repair. Chromosomal mutation - numerical and structural changes. Genetic disorders and chromosomal disorders.

UNIT V:

Human Genetics: Pedigree analysis - Karyotypes, Chromosomal banding, Inborn error in metabolism, Genetic disorders of Human beings - Sickle cell anemia, Thalassemia, Diabetes mellitus, Brachydactyly and Huntingtons chorea. Population genetics: Hardy Weinberg law, Eugenics, Euthenics, Euphenics, Inbreeding - homozygosity.

Text Books:

1. Verma P.S and V.K. Agarwal (2008). Genetics. S. Chand and Company Private Ltd. New Delhi.

Books for reference:

1. Watson J.D., Hopkins N.H., Roberts J.W., Steitz J and A.M. Weiner (1987). Molecular Biology of Genes (4th edition). The Benjamin/Cummings publishing Company inc, Joky.
2. Lewin B (1997). Genes VI. Oxford University Press, Oxford, New York, Tokyo.
3. Kavitha Bhutiani Ahluwalia (1985) Genetics, Wiley Eastern Limited, New Delhi.
4. Alice Marav (2009) Genetics, MJP Publishers, Chennai.
5. Eldon J. Garder (1968) Principles of genetics, Wiley Eastern private Limited, New Delhi.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Learn and recall the organization and functions of genetic material in the living system.	K1
CO2	Understand various sequential processes in Gene interaction, Linkage and Crossing over, Sex determination, gene transfer, Mutation and protein synthesis	K2
CO3	Understand the principle and application of rDNA technology for the welfare of human being.	K3
CO4	Distinguish lytic and lysogenic cycle and explain the mechanisms of genetic recombination of the microbes. Explicate the structures and functions of chromosomes and identify the diseases caused by the chromosomal abnormalities.	K4
CO5	Evaluate and Create pedigree charts	K5&K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	2	1		1
CO2	3	3	2	3	2		1
CO3	3	3	2	3	1		
CO4	2	3	2	3	1		
CO5	3	3	2	2			
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (5X5=25)	1 question from each unit (3X10=30)

Amulya

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	4	40	60	100

Course Contents

CELL BIOLOGY

1. Determination of cell size using micrometer
2. Mitosis in root meristematic cells of plants
3. Identification of blood cells in the haemolymph of the cockroach
4. Isolation of genomic DNA from eukaryotic tissue
5. Agarose gel electrophoresis of DNA
6. SDS-Polyacrylamide gel electrophoresis

Spotters

7. DNA Structure
8. Camera Lucida

GENETICS

9. Drosophila culture.
 10. Identifications of sex.
 11. Identifications of mutants.
 12. Identification of Blood groups ABO and Rh factors.
 13. Pedigree analysis.
 14. Human karyotyping.
 15. Chromosomal abnormalities.
 16. Hardy Weinberg law and Calculation of gene frequencies for dominant, recessive and codominant traits and Multiple alleles.
- 1 or 2 Major/ Minor/ Spotter excises will be added in accordance with selection of Elective courses

Text Books:

1. Jayasuriya, D. Fatima, R.P. Meyyan, S. Prasannakumar, A. Mani, A. Mariakuttikan, N. Arumugam, L.M. Narayanan, K. Nallasingam, V. Kumaresan, A.M. Selvaraj. 2017. Practical Zoology-Vol-3. Saras publication, Nagercoil, Tamilnadu.
2. Ajoy Paul, Practical Zoology. Books & Allied Pvt. Ltd. Kolkata.
3. P.S. Verma and P.C. Srivastava, 2020. Advanced Practical Zoology, S Chand and Company Ltd. New Delhi.

Books for reference:

1. Sudha Garg, Cell biology and Cytogenetics lab, Practical Zoology I, Pragati Prakashan, 2023.
2. Yadav & Varshney, 2021. Modern Practical Zoology-1. Kedar Nath Ram Nath, Meerut.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Learn and recall the cytological and molecular techniques	K1
CO2	Understand the principles behind the procedures adopted.	K2
CO3	Apply the rDNA technology for the welfare of human being.	K3
CO4	Explicate the structures and functions of chromosomes and identify the diseases caused by the chromosomal abnormalities.	K4
CO5	Evaluate and Create pedigree charts	K5&K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	1	3	1		
CO2	2	3	1	3			
CO3	3	3	2	3	1		
CO4	3	3	3	3			
CO5	3	3	2	2			
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern: (Internal 40 + External 60 = 100)

Section A	Section B	Section C
1 x 20 = 20	2 x 10 = 20	Viva = 5 Spotters = 10 Record = 5

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-II **ELECTIVE COURSE-III**

CODE: NANOTECHNOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT I Introduction – Nano materials: Definition , Types – nanotubes, nanospheres, fullerenes – properties of nanomaterials.
UNIT II Preparation of Nano materials, Top down approach – Ball milling method: Synthesis of Nano materials – Bottom up approach, Gas phase evaporation – Sol gel processing – reverse micellar techniques.
UNIT III Applications of Nanotechnology in health Applications of Nanotechnology in Food, Diagnosis – biosensors and Bio labelling. Quantum dots, Magnetic Nano particles, Devices based on Nano technology for Diagnosis.
UNIT IV Nano medicines: Developing Nano medicines, Nano systems in use, protocols for Nano drug administration – Nano materials as therapeutic agents – Drug delivery systems.
UNIT V Application of Nanotechnology in Environment – Nano materials in pollution abatement – Nano materials in sensors – Nano materials in Green nanotechnology.

Text Books:

1. AMIT CHAKRAVARTHY, Nanotechnology – An Introduction, Rajat Publications.

Books for reference:

1. G.B. SERGEEV, Nanochemistry, Elsevier India Pvt Ltd. New Delhi
2. Y.S. RAGHAVAN, Nanostructures & Nanomaterials, Arise Publishers, New Delhi
3. B. VISWANATHAN, Nanomaterials, Narosha Publishing Home, New Delhi
4. MICHAEL WILSON, KAMALI KANANGARA, Nanotechnology.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Master the theoretical knowledge of various fields in nanotechnology.	K1
CO2	Acquire and perform various experiment-related aspects of nanotechnology.	K2
CO3	Apply the knowledge of nanomaterials in the medical, agriculture, and environmental protection.	K3
CO4	Analyze the properties of nanomaterials.	K4
CO5	Develop nanomedicines	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	4	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	4	2	2	3	2
CO4	4	3	2	2	3	2	1
CO5	3	2	3	3	2	2	
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 5x5=25 1 question from each unit 3x10=30

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.Sc., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER – II ELECTIVE COURSE – III

PZDE2:2

CODE: MICROBIOLOGY AND IMMUNOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT I: Innate and Acquired Immune systems. Organs of immune system: Primary – Thymus, Bone marrow, Secondary – Spleen, Lymphnodes, Tonsils. GALT and MALT. Cells of Immune system: Haematopoietic stem cells, cells of lymphoid lineages – Lymphocytes, NK cells, K cells, Myeloid lineage – granulocytes, Neutrophils, Eosinophils, Accessory cells. Major effectors: Major effector components of cellular immune system: Lymphocytes – types, morphology, clones; sub-populations, distribution, B and T cell receptors, B and T cell epitopes, Toll like receptors

UNIT II: Antigens: Definition, Characteristic features and classification; Antigenicity versus immunogenicity; Adjuvants: definition, types and applications. Major effector components of humoral immune system: Antibodies – Primary structure, Classification, Variants and antigen- antibody interactions; Structural and functional characteristics of various antibody classes: Generation of diversity: Complement system – Components, three major activation pathways and immune functions including anaphylaxis and inflammation. Cytokines – Definition and salient functional features: Interleukins; definition, types (lymphokines and monokines), and functions. Interferons – Origin, types and functions.

UNIT III: Immune Responses – Humoral and Cell mediated Immune responses. Antigen presenting cells: antigen processing and presentation, MHC molecules and their immunological significance. Disease and immune response: Hypersensitivity: definition, types I to V and mechanism of Anaphylaxis. Auto immune diseases: onset, spectrum of diseases and major immune responses. Transplantation Immunology – Types of graft, mechanism of allograft rejection. Graft versus. Host reaction, Prevention of graft rejection. Tumour Immunology – Tumour antigens, Immune responses to tumours – immune surveillance- Escape mechanism from immune response. Immunotherapy for tumours. Immune prophylaxis: Vaccines: types, preparations, efficacies and recent developments.

UNIT IV: Scope and history of microbiology – Classification of microorganisms, general methods of classifying bacteria, Morphology and fine structure of bacterial cells – cell wall and peptidoglycan in Gram positive and Gram negative bacteria – Reproduction of bacteria and viruses (Lytic and lysogenic cycles). Bacterial growth and nutritional requirements, Culture media and growth conditions.

UNIT V

Mixed and Pure cultures – Streak plate, pour plate and spread plate techniques. Food as a medium for the growth of microorganism - Food preservation by high and low temperature- Infections – Types, Methods of transmission of infections, Sources of Infections. Nosocomial infections -Bacterial infections- Cholera. Viral infections- AIDS. Fungal infections – Candidiasis, Antibiotics – penicillin and tetracycline.

TextBooks:

1. Gupta S.K (1999). Immunology. Narosa Publishing House, New Delhi.
2. Annadurai B (2013). A Text book of Immunotechnology. S.Chand publication. (Add place)
3. Pelczar M.J., Reid R.D and E.C.S Chan (1996). Microbiology. V Ed., TataMcGraw Hill Publishing Company Ltd., New Delhi.

Books for reference:

1. Ivan Roitt (1994). Essential Immunology (8th Edition). Blackwell Scientific Publication. Immunology W.H. Freeman and Company.
2. Weir D.M and Stewart J (1997). Immunology. 8th Edn., Churchill Livingstone, New York.
3. Kuby J (1994). Immunology. W.H. Freeman and Co., New York.
4. Ashim K and Chakravathy. Immunology and Immunotechnology. Oxford Publications. (Add year & place)

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Understand the types and functions of immune system.	K1
CO2	Induct basic concepts of antigenicity and immunogenicity	K2
CO3	Understand the principles of hypersensitivity and develop theoretical knowledge on tissue and organ transplantation. Integrate knowledge of immune prophylaxis (Vaccine). Auto immunity And tumour immunology.	K3
CO4	Understand the classification and structure of microorganisms. Obtain the knowledge of nutritional requirements for growth of microbes.	K4
CO5	Attain the knowledge of infectious diseases caused by microbes.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	3	4	3	3	2	2
CO2	3	2	3	2	2	3	2
CO3	4	3	4	3	2	2	3
CO4	3	3	4	2	3	2	2
CO5	3	4	4	3	3	3	3
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice questions from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (3X5=15)

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBakonam
DEPARTMENT OF ZOOLOGY
M.Sc., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-II ELECTIVE COURSE-IV

CODE: BIOTECHNOLOGY AND BIOINFORMATICS

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT-I : Basic Tools for Gene Manipulation:

Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics). Restriction enzymes: Nomenclature, Types. Transformation techniques: Calcium chloride method, electroporation and biolistic method. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization

UNIT-II: Advance Tools and Techniques:

Southern, Northern and Western blotting DNA sequencing: Sanger method, Polymerase Chain Reaction, DNA Finger Printing and DNA micro array.

Genetically Modified Organisms:

Production of cloned and transgenic animals: Nuclear Transplantation. Retroviral Method, DNA microinjection; Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.

UNIT-III :

Applications of biotechnology in agriculture (Agrobacterium-mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants, Biopesticides and Biofertilizers) medicine (insulin) and food science. Genetically modified organism (GMO'S) - GM foods. Bioremediation - bioremediation of hydrocarbons - Industrial wastes - Heavy metals - Xenobiotics - bioleaching - biomining - biofuels.

UNIT-IV:

Introduction to Bioinformatics, Databases-Nucleic acid databases, Protein sequence databases, Databases of structures, Specialized databases, Bibliographic databases. Outline of Genomics and Proteomics. Steps involved in Drug Discovery.

UNIT-V

Structure based Protein classification, Protein structure databases-PDB, NCBI, Visualization databases - Rasmol, Swiss-PDB and PDBsum. Structure visualization database.

Text Books:

1. Dubey R.C (2008). A text Book of Biotechnology. S. Chand and Company, New Delhi.
2. Sathyanarayana U (2005). Biotechnology. Books and Allied P. Ltd. Kolkata.
3. B.D.Singh(2003). Biotechnology, Kalyanipublishers. Ludhiana, New Delhi

Books for reference:

1. Brown C.M., Campbell I and F.G Priest (1988). Introduction to Biotechnology. Blackwell Scientific Publications, UK.
2. Primrose S.B (2000). Modern Biotechnology. Blackwell Scientific Publications, Oxford, London.
3. Watson et.al., (1999). Recombinant DNA. Freeman and Company, New York

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Recall the fundamental tools and techniques in Biotechnology and bioinformatics	K1
CO2	Explain the characteristics and applications of various genetic engineering tools.	K2
CO3	Apply knowledge to perform and utilize gene manipulation techniques, Utilize bioinformatics tools and databases for genomic and proteomic analysis, as well as for drug discovery processes.	K3
CO4	Analyze the processes and outcomes of various gene manipulation techniques, the effectiveness of different transformation methods, the accuracy and reliability of DNA sequencing and fingerprinting methods, the impact of GMOs in agriculture, medicine, and food science, the environmental implications of bioremediation, and the utility of bioinformatics databases in research.	K4
CO5	Integrate and evaluate information on the advanced tools and techniques of biotechnology. Formulate new research questions, design experiments, and critically assess the implications of biotechnological advancements in various fields.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	4	3	3	2	3
CO2	4	3	3	3	3	3	3
CO3	3	4	4	3	3	2	3
CO4	4	3	3	3	3	3	3
CO5	4	3	3	3	2	3	3
Weightage							
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (3X5=15)

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.Sc., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-II ELECTIVE COURSE-IV

CODE: BASIC MEDICAL KNOWLEDGE

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT-I Basic Blood tests- complete blood count, white blood cell count, differential WBC count, RBC count, hematocrit, packed cell volume, hemoglobin, Erythrocyte sedimentation rate, platelet count. Bleeding time, clotting time, Hemostasis and Coagulation.
UNIT-II Biochemical studies – Blood glucose-fasting and post prandial, Glucose tolerance test. Thyroid function test – free thyroxine T3 and T4 TSH. Lipoprotein test – Total cholesterol HDL, LDL, VLDL, Triglycerides. Liver function test.
UNIT-III Urine analysis – Routine analysis – Urine volume, colour, urine protein, bilirubin, urobilinogen. Renal function test.
UNIT-IV Pregnancy – Ultra sound scan – Amniocentesis. Amniotic fluid analysis.
UNIT-V Types of endoscopy, ECG, EEG, CT scan, MRI scan.

Books for reference:

1. Frances Fischbach and Marshall B. Dunning (2014). A manual of laboratory and diagnostic test. Fifth edition, LWW Publisher, Lippincott. 2. Ditmer W.M Norwalk, CT, Applenton and Lane et al, (1992). Pocket Guide to Diagnostic test

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Understand the significance of importance of routine blood tests and investigations	K1
CO2	Gain the knowledge of blood glucose, thyroxine, lipo-protein and liver function tests	K2
CO3	Learn the routine urine and renal function tests.	K3
CO4	Understand Pregnancy and amniotic fluid tests	K4
CO5	Acquire the knowledge of radiological Analysis including CT, MRI scan	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	4	3	4	3	2	2
CO2	4	3	3	3	3	2	3
CO3	3	4	3	4	2	3	2
CO4	4	3	3	3	2	3	3
CO5	3	3	4	3	3	2	3
Weightage							
Weighted% of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (3X10=30)

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.Sc., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER - II
SEC - II

CODE:

APICULTURE

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	2	-	-	1	25	75	100

Course Contents

UNIT I:

Introduction to Apiculture. History, classification, types, life Cycle of different species of Honey Bees and their behavioral patterns. Social organization of bee colony

UNIT II:

Bee-keeping system, tools and equipment's needed for bee keeping. Types of bee hives, structure and functional features Criteria for site selection for apiculture and factors affecting them.

UNIT III:

Identification and characteristics and Preventive measures to be taken against of different bee enemies. Diseases affecting honey bees and their control measures. Colony collapse disorder and its management.

UNIT IV:

Bee products, uses and importance- Honey, Royal jelly, Propolis, Pollen and Bee venom. Harvesting, Processing, Packaging and Marketing of bee products.

UNIT V:

Apiculture industry around the world and Role of Central Bee Research & Training institute in India. Apiculture as an Entrepreneurial venture.

Text Books:

1. Singh, D., Singh, D. Pratap. 2006. A Handbook of Beekeeping. AGROBIOS (INDIA)
2. Sharma P.L. and Singh, S.H. Book of Bee keeping.
3. Cherian and Ramanathan, S. Bee keeping in south India.
4. Prospective in Indian Apiculture - R.C. Mishra.

Books for reference:

- (1) Caron, D.W. 2013 (revised from 1999). Honey Bee Biology and Beekeeping. Wicwas Press. Cheshire, CT, 368 pp. (2) Kaspar, R., C. Cook, and M. D. Breed. 2018. Animal Behaviour 142: 69-76. (3) Hendriksma, H. P., A. L. Toth, and S. Shafir. 2019. Individual and Colony Level Foraging decisions of Bumble Bees and Honey Bees in Relation to Balancing of Nutrient Needs. Frontiers in Ecology and Evolution 7: 177. (4) Steinhauer, N. et al. 2018. Drivers of Colony Loss. Current Opinion in Insect Science 26: 142-148.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Knowledge on the harvesting, preserving and processing of bee products	K1
CO2	Clear understanding of morphology, life cycle, characteristics of honey bees and bee keeping.	K2
CO3	Identification of the appropriate markets to sell the produce.	K3
CO4	Analyse different types of beekeeping practices and bee species in order to select suitable species and types.	K4
CO5	Acquired skills to perform bee keeping from managing colonies of bees in order to harvest honey and other Bee related by-products in different setups and as an Entrepreneurial venture.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Weightage	3	3	3	3	3	3	3
Weighted % of Course contribution to POs							

Very Strong-4 Strong-3 Medium-2 Low-1

Question pattern:

Section - A
1 (a & b) question from each unit (5 X 15 = 75)

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
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OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER-III

PZC307

CORE COURSE – VII

CODE:P23ZC307 DEVELOPMENT BIOLOGY AND EVOLUTION

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course Contents

UNIT I: A fertilization - Parthenogenesis: Types, Natural and Artificial- significance. Fertilization - Gametogenesis: Origin of germ cells, Spermatogenesis - Formation of spermatids, Spermiogenesis. Structure of spermatozoa: Oogenesis - Oogenesis in insects and amphibians; types of eggs, polarity and gradient, significance of oogenesis. Physiological and biochemical changes in fertilization significance. UNIT II: Cleavage: Patterns and Planes of cleavage. Gastrulation: Factors affecting gastrulation, mechanisms and types of gastrulation in animal embryos . Fate maps - Amphibian and Chick. Embryonic Development of Birds, formation of extra embryonic membranes in mammalian - (Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives. UNIT III: Post Embryonic Development Metamorphosis: Endocrine control of metamorphosis in insect and amphibian. Regeneration: Types of regeneration in planaria. Regenerative ability in different animal groups, Factors stimulating regeneration - Biochemical changes associated with regeneration. Aging and senescences: Biology of senescences- cause of aging. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Induced ovulation - Cryopreservation of gametes / embryos - Ethical issues in cryopreservation. EVOLUTION UNIT IV: Origin of biological molecules and origin of life – Concept of Oparin and Haldane- Experiment of miller (1953). Emergence of evolutionary thoughts: Lamarckism, Darwinism and Neo Darwinism – Types of Evolution - Micro, Macro, Mega, Quantum, Monophyletic. Polyphyletic, Parallel and iterative evolution. The evolutionary Time Scale – Origin of unicellular and multicellular organism – Stages in primitive evolution including Home sapiens. UNIT V: Molecular tools in phylogeny, classification and identification – Protein and nucleotide sequence analysis – Origin of new genes and proteins – Gene duplication and divergence – Population. Gene pool, Gene frequency – Hardy-Weinberg Law – Concepts and rate of change in gene frequency through natural selection (Gene flow and Genetic drift) Adaptive radiation. Isolating mechanism –Speciation – Allopatricity and Sympatricity.	
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Text Books:

1. Balinsky, B. I. 1981. Introduction to Embryology (5th Edition), CBS College Publishers, New York, pp-782. (2) Gilbert. S. F. 2006. Developmental Biology, 8th Edition, INC Publishers, USA, pp-785. (3) Berrill, N.J. 1974. Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi, pp-535. (4) Tyler, M.S. 2000. Developmental Biology - A Guide for Experimental Study, Sunderland, MA, pp-208.
2. Rastogi, V.B (1985). Organic evolution kedarnath and raronath press.
3. Verma .P.S, Agarwal V.K (2016). Call biology S.chand and, company PVT.LTD.Newdelhi.

Books for reference:

- (1) Wilt, F.H. and N.K. Wessel. 1967. Methods in Developmental Biology, Thomas Y Crowell, New York. (2) Slack J.M.W. 2012. Essential Developmental Biology (3rd Edition), Wily-Blackwell Publications, USA, pp-496. (3) Mari-Beffa, M. and J. Knight. 2005. Key Experiments in Practical Developmental Biology, Cambridge University Press, UK.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Understand the biological process involved in the development.	K1
CO2	Describe the intricate process of fertilization.	K2
CO3	Explain organogenesis.	K3
CO4	Understand the origin of life.	K4
CO5	Understand various theories of evolution.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	2		2
CO2	2	3	3	2	1	1	2
CO3	3	2	3	3	2	1	2
CO4	2	2	3	2			2
CO5	2	3	3	3	1		2
Weightage							
Weighted % of Course contribution to POs							

Very strong – 4

Strong-3

Medium-2

Low- 1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit (6X5=25)	1 question from each unit (3X10=30)

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY

OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER- III

CODE: P23ZC308

PZC308
ANIMAL PHYSIOLOGY

CORE COURSE - VIII

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course Contents

UNIT I: Digestive system: Digestion, absorption, energy balance, BMR. Respiratory system: Comparison of respiration in fishes, Birds and Mammals, transport of gases, neural and chemical regulation of respiration
UNIT II: Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis. Cardiovascular system : Comparative anatomy of heart structure, myogenic heart, specialized tissue. ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure.
UNIT III: Nervous system - Anatomy of the brain and spinal cord, Neuron – structure and types, central and peripheral nervous system, neural control of muscle tone and posture. Sensory organs: Physiology of Vision, hearing and tactile response
UNIT IV: Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, electrolyte balance, acid-base balance
UNIT V: Endocrinology: Endocrine glands – Pituitary, Adrenal, Thyroid, Pancreas, basic mechanism of hormone action, hormones and diseases - neuroendocrine regulation. Thermoregulation: Comfort zone, body temperature- physical, chemical, neural regulation, acclimatization: Stress and adaptation

Text Books:

(1) Prosser C. L. 1991, Comparative Animal Physiology. Part A: Environmental and Metabolic Animal Physiology. Wiley-Liss Publishers, pp-592. (2) Hoar, S.W. 1983, General and Comparative Physiology, Prentice Hall Publication, pp-928. (3) Randall, D., W. Burggren, K. French and R. Eckert. 2001, Animal Physiology Mechanisms and Adaptations, New York : W.H. Freeman and Co., pp- (4) Nelson K. S. 1997. Animal Physiology: Adaptation and Environment, Cambridge University Press, pp- 617.

Books for reference:

(1) Shepherd, G. M. 1994, Neurobiology, OUP USA Publisher, pp-774. (2) Hainsworth, F.R. 1981. Animal Physiology: Adaptation in function, Addison Wesley Longman Publishers, pp-669. (3) McFarland, D. 1999. Animal Behaviour: Psychobiology, Ethology and Evolution, Longman Publisher, pp-592. (4) Gordon, M.S. et al., 1977. Animal Physiology: Principles and Adaptation, New York, Third Edition.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Understand the functioning of digestive system and the importance of vitamins and minerals in human pathology	K1
CO2	Gain the knowledge on functioning of circulatory system, components of blood, significance in cardiac diseases. Improve the knowledge on gaseous exchange through respiration process.	K2
CO3	Understand the physiological functions of muscle, nervous system	K3
CO4	Acquire knowledge on the functioning of excretory system in relation to different habitats and homeostasis mechanism in crustaceans and fishes.	K4
CO5	Obtain the knowledge on human health related issues and Endocrine glands.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	2	3	1	2	
CO2	2	3	2	3	2	3	
CO3	3	3	3	2	1	1	
CO4	3	3	3	2	1	1	
CO5	3	3	3	2	1	2	
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 3x10=30
		5x5 = 25

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER- III **PZC309** CORE COURSE-~~X~~
CODE: P23ZC309 BIostatistics AND RESEARCH METHODOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course Contents

UNIT-I Introduction to biostatistics - scope and definition, functions and limitations. Collection, organization (classification and tabulation of data) and presentation (graphical representations) of data. Measures of central tendency - mean, median and mode. Measures of dispersion - range, inter quartile range, mean deviation, standard deviation and Standard error.
UNIT-II Skewness and kurtosis, measures of skewness, Karl-Pearson's coefficient of skewness, Bowley's measures of skewness, types of coefficient of skewness, types of kurtosis. Correlation analysis (Karl-Pearson's) - types and methods, Regression analysis-regression line and regression equation.
UNIT- III Hypothesis testing, Chi-square test, One-way Analysis of variance, Student's t-test. Probability theory - Normal, Binomial and Poisson distributions (theory only).
UNIT-IV Literature collection: kinds of literature - primary, secondary and tertiary, sources of literature - books, edited volumes, peer-reviewed journals, e-journals, biological abstracts, and Magazines. Online browsing of research articles: infonet and infolibnet.
UNIT-V Preparation of research dissertation -components of thesis, proofreading, preparation of bibliography. Preparation of Scientific paper for publication in a peer peer-reviewed Journal. Web of Science, SCOPUS, SCI Index, Thompson Rheutter, Details of impact factor, citation index, and h-index.

TextBooks:

1. Milton J.S (1992). Statistical methods in Biological and Health Sciences. McGraw Hill Inc., New York. (2) Gupta S. P (1988). An easy approach to statistics. Chand and Co., New Delhi. (3) Day R.A (1994). How to write and publish a scientific paper. Cambridge University Press, London.

Books for reference:

1. Anderson, Durston and Polle (1970). Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi. (2) Comir and Peter Wood Ford (1979). Writing scientific papers in English. Pitman Medical Publishing Co., London.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Acquire in-depth knowledge of Statistical methods and presentation of data in research.	K1
CO2	Understand various statistical tools, concepts and their applications	K2
CO3	Apply the relevant statistical tools for data analysis.	K3
CO4	Analyse, present and interpret the research data	K4
CO5	Frame new research designs and conduct research,	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO 1	PSO 2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	4	4	4	2	2	4
CO2	4	3	3	3	3	2	4
CO3	3	4	4	4	2	3	4
CO4	4	4	4	4	2	2	4
CO5	3	2	3	3	2	3	3
Weightage							
Weighted % of Course contribution to POs							

Very strong -4

Strong-3

Medium-2

Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 3x10=30
	5x5 = 25	

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY (PRACTICAL)
OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER- III CORE COURSE - X
CODE: P23ZC310P LABORATORY TECHNIQUES
IN ZOOLOGY - PRACTICAL III

P23ZC310P

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
PRACTICAL	6	-	-	5	40	60	100

Course Contents

A.DEVELOPMENTAL BIOLOGY

- 1.Whole mount of chick embryo – 24hrs, 36 hrs, 72hrs and 96 hrs.
- 2.Observation of prepared slides for developmental stages in frog.
- 3.Effect of thyroxine on metamorphosis of tadpoles.
- 4.Observation of regeneration in tail of tadpoles.

B. EVOLUTION

- 1.Observation of forelimbs or hind limbs of vertebrates (Frog, Calotes, Bird and Mammal) to demonstrate the common pattern of pentadactyl limb and common ancestry of vertebrates.
- 2.Report on evidences for evolution based on your observation in field visit.
- 3.Observation of leaf insects and stick insects in the museum to demonstrate adaptation by cryptic colouration and natural selection.
- 4.Observation of Monarch and Viceroy butterflies to demonstrate Batesian mimicry.
- 5.Spotter: Archeopteryx, Grand Canyon, Limulus, Peripatus and fossils.

C.ANIMAL PHYSIOLOGY

- 1.Quantitative estimation of amylase activity.
 - 2.Rate of salt loss and salt gain in fish using different experimental media.
 - 3.Estimation of blood chloride.
 - 4.Estimation of haemoglobin.
 - 5.Blood - Bleeding time and clotting time.
 - 6.Effect of osmolarity on erythrocytes
- 1 or 2 Major/ Minor/ Spotter excises will be added in accordance with selection of Elective courses

Text Books:

Jayasuriya, D.Fatima, R.P.Meyyan, S.Prasannakumar, A.Mani, A.Mariakuttikan, N.Arumugam, L.M.Narayanan, K.Nallasingam, V.Kumaresan, A.M.Selvaraj. 2017. Practical Zoology-Vol-3. Saras publication, Nagercoil, Tamilnadu.
Ajoy Paul, Practical Zoology. Books & Allied Pvt. Ltd. Kolkata.
P.S.Verma and P.C.Srivastava, 2020. Advanced Practical Zoology. S Chand and Company Ltd. New Delhi.

Books for reference:

- 1.SudhaGarg, Cell biology and Cytogenetics lab, Practical Zoology I, PragatiPrakashan, 2023.
2. Yadav&Varshney, 2021. Modern Practical Zoology-I. KedarNath Ram Nath, Meerut.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Remember the different stages of chick and frog embryology methodologies for different physiological experiments.	K1
CO2	Understand the process of developed, regeneration, evolutionary concept and principles behind the physiological experiments.	K2
CO3	Apply the principles of theoretical knowledge gained in the embryology, evolution and animal physiology subjects in field and laboratory experiments	K3
CO4	Experiments and developments the objectives following a standardized protocol.	K4
CO5	Evaluate the results obtained and draw conclusions based on the interpretation of data obtained.	K5 &K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO 1	PSO 2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	4	4	3	3	2	3
CO2	3	3	3	3	3	3	3
CO3	4	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3
CO5	4	3	3	3	3	3	2
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3 Medium-2 Low-1

Question pattern:

SectionA	SectionB	SectionC
1 X 20 =20	2X 10 = 20	Record = 5 Spotters = 10 Viva = 05

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY (PRACTICAL)

OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-III ELECTIVE COURSE-V
CODE: P23ZCE3:1 MEDICAL LABORATORY TECHNIQUES

PZDE3:1

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
PRACTICAL	4	-	-	3	25	75	100

Course Content

UNIT I: Laboratory safety – toxic chemicals and biohazards waste- biosafety level- good laboratory practice – hygiene and health issue – physiology effect of alcohol, tobacco, smoking and junk food and its treatment - biomedical waste management.
UNIT II: Composition of blood and their function- collection of blood and lab procedure-haemopoiesis- types of anaemia- mechanism of blood coagulation- bleeding time- clotting time- determination of hemoglobin-erythrocyte sedimentations rate- packed cell volume- Total count of RBC and WBC- Differential count WBC- blood grouping and typing- haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count. Absolute Eosinophil count.
UNIT III: Definition and scope of microbiology- structure and function of cells - parasites - Entamoeba- Plasmodium- Leishmania and Trypanosome-Computer tomography (CT scan) - Magnetic Resonance imaging - flowcytometry - treadmill test - PET.
UNIT IV: Cardiovascular system- Blood pressure - Pulse - regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) - significance - ultra sonography- Electroencephalography (EEG).
UNIT V: Handling and labelling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtome- sectioning, staining - staining methods - vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.

Text Books:

1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai. (2) 2. Guyton and Hall, 2000. Text Book of medical Physiology, 10th edition, Elsevier, New Delhi. (3) 3. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol.I,II,III. Tata MC GrawHill, New Delhi. (4) 4. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.

Books for reference:

(1) Manoharan, A, and Sethuraman, 2003. Essential of Clinical Hematology, Jaypee brothers, New Delhi. (2) Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia. Published by Tata McGraw-Hill Education Pvt. Ltd., (3) Ochei, J., A. Kolhatkar (2000). Medical Laboratory science: Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Understand protocols and procedures to collect clinical samples for blood analysis and to study human physiology.	K1
CO2	Explain the characteristics of clinical samples and demonstrate skill in handling clinical equipment.	K2
CO3	Evaluate the hematological and histological parameters of biological samples.	K3
CO4	To analysis the cardiovascular system	K4
CO5	Understand the tissue processing and microtome techniques.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	4	4	3	3	2	3
CO2	4	4	3	4	3	2	2
CO3	3	4	3	4	3	2	2
CO4	4	3	4	3	3	2	3
CO5	3	4	4	3	3	2	3
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3 Medium-2 Low-1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 5x5 = 25	1 question from each unit 3x10=30

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY (PRACTICAL)

OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER-III ELECTIVE COURSE-V
CODE: P23ZCE3:2 DAIRY SCIENCE

PZDE 3:2

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
PRACTICAL	4	-	-		40	60	100

Course Contents

UNIT I Dairy farming-Definition-Scope-Role of Co-operative societies in milk production and marketing
UNIT II Dairy breeds of India and its Classification-Exotic Cow Breeds-Jersey and Red sindhi. Indian breeds-Kangayam, Buffalo-Murrah.
UNIT III Common cattle feed and their nutritive value-Balanced ration for cattle
UNIT IV Milk-composition-Nutritive value and Pasteurization of milk. Milk products - Butter, Ghee, Cheese.
UNIT V Bacterial diseases - Anthrax, Mastitis. Viral disease - Foot and mouth disease, Non-contagious disease, Milk fever.

Text Books:

1. Shivasharayasingh (2013) Dairy technology vol- 01: Milk and milk processing

Books for reference:

1. 2. Shivasharayasingh (2013) Dairy technology vol-02: Dairy products and quality assurance 3. Y.H.Hui (1992) Dairy science and technology Handbook. 4. Jadish Prasad (2016) Principles and practices of Dairy farm management

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Know the role of co-operative society for milk production and marketing	K1
CO2	Differentiate the dairy breeds as exotic cow breeds and native breeds	K2
CO3	Acquire knowledge of cattle feed and their nutritive value	K3
CO4	Understand the nutritive value of milk and the significance of pasteurization of milk	K4
CO5	Gain knowledge on the bacterial diseases of cattle and to manage them	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	4	4	3	1	1	2
CO2	4	3	4	3	1	1	2
CO3	3	4	4	3	1	1	2
CO4	3	3	4	3	2	2	3
CO5	3	4	3	2	1	2	3
Weightage							
Weighted % of Course contribution to POs							

Very strong -4

Strong-3

Medium-2

Low-1

Question pattern

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 3x10=30
	5x5 = 25	

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER-III
CODE: P23ZC3IDC **DIET FOR HEALTHY LIFE** **IDSEC**
P23IDC

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	2	-	-	1	25	75	100

Course Contents

UNIT-I Processed and ready to eat food: Balanced diet-need for balanced Diet - Types of food, according to their function (Energy rich, Body building and protective). Processed food, instant foods, fast foods, street food, junk foods.
UNIT-II Diet during different stages of Life-Diet for infant-Diet for growing child-Diet for pregnant and lactating mother
UNIT-III Role of different kinds of food materials on health a) Vegetables and fruits in diet b) Different kinds of fats/oils (Animal fat, Vegetable fat, visible and nutritive fats, Vanaspati), c) Salt intake, d) Sugars, e) Whole grains, f) Water & Beveragesg) Milk & Soft drinks, Tea, Coffee, Energy drinks, Tender coconut water, Alcohol.
UNIT-IV 1. Best practices for storage-Handling of Perishable foods-Dairy, Fresh fruits and Vegetables, egg, Non vegetarian foods 2. Personal hygiene 3. Removal or reduction of pesticides-washing, balancing, peeling, cooling 4. Beware of adulterants-common adulterants.
UNIT-V Healthy cooking practices pre cooling preparation, washing and cutting of raw food, cooling methods. Diet and weight management-Healthy foods, Tips to reduce body weight - Naturopathy

Text Books:

Health diet-Published in Nation Health portal, Ministry of Health and family welfare validated by Nutritional IDD cell, DGHS, MOHFW, GOI.

Webreferences:

1. www.indianmedicine.nic.in
2. <http://ninindia.org/DietaryguidelinesforIndians-Finaldraft.pdf>
3. http://readynutrition.com/resources/are-you-ready-series-best-practices-for-long-term-food-storage_03042011/

Course Outcomes: On completion of the course, students will be able to:	Level
CO1 Gain knowledge to have a healthy life	K1
CO2 Acquire knowledge on healthy foods	K2
CO3 Adopt personal hygiene	K3
CO4 Obtain the concepts of nutritional requirements for healthy life.	K4
CO5 Enrich the knowledge of faulty food habits and proper health management	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	4	3	3	4	3	2
CO2	4	3	3	3	2	3	2
CO3	3	4	4	4	2	3	2
CO4	4	3	4	4	4	3	2
CO5	4	4	4	3	3	3	3
Weightage							
Weighted % of Course contribution to POs							

Very strong -4
Question pattern

Strong-3 Medium-2 Low-1

Section A
5x15 = 75

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P28ZCH11

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDITS SYSTEM
SEMESTER-IV
CORE COURSE – XI

CODE: ECOLOGY AND ETHOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	6	-	-	5	25	75	100

Course

UNIT- I

Contents

Ecology: Scope of Ecology - kinds of Ecosystem; Structure of Ecosystem – Abiotic (Temperature and Soil) and Biotic component. Liebig's law of Minimum, Shelford law of Tolerance. Ecological pyramids - Pyramids of numbers, biomass, energy. Functions of an Ecosystem - productivity of Ecosystem, Food chain, Food webs - Energy flow in Ecosystem; Biogeochemical cycle – Carbon and Nitrogen.

UNIT- II

Population Ecology: Density, Dispersion, Age structure, Natality, Mortality, Dispersal, Dispersion. Regulation of population density, Population interactions- Animal associations. Community Ecology: Structure, Stratification, Periodicity, Interdependence, Ecological niche, Ecotone, Edge effect, Succession, Climax.

UNIT-III

Pollution - Ecological Aspects of Pollution, kinds of pollution - (Air, water, Soil, Noise, Thermal, Radiation, Plastics and Pesticides) and their source, effects and control measure. Acid Rain- Greenhouse effect-Ozone and its importance- Global warming. Environmental Impact Assessment – Need, Methods.

UNIT- IV

Animal behaviour: Definition of Ethology- Approaches to behavioural study (Field and Laboratory methods). Types of behavior: Innate - Reflexes, Taxes, Instincts. Acquired behaviour- Habituation, Imprinting, learning (Conditioning, trial and error, insight or reasoning).

UNIT-V

Animal behaviour: Feeding and Anti predator behaviour, Aggressive behaviour, Sexual behaviour and Selection, Family and group behaviour, Dominance behaviour. Animal Communication: Visual, Olfactory, Auditory, Tactile and Chemicals.

Text Books:

1. Veer Bala Rastogi and Jayaraj M.S. (1998) Animal Ecology and distribution of animals - Eighth edition - Kedar Nath Ramnath Publications, Meerut.
2. Verma P.S and Dr. Agarwal V.K (1983). Environmental Biology- S. Chand and Company Pvt. Ltd – New Delhi.
3. Dr. V.K. Agarwal (2009) Animal behavior (Ethology) First edition S. Chand & Company PVT-New Delhi.

Books for reference:

- (1) Gundevia H.S and Hare Govind Singh (1998). A text book of Animal Behaviour - S. Chand and Company Ltd, New Delhi.
- (2) Sharma P.D (2008-2009). Ecology and Environment - Rastogi Publications, New Delhi.
- (3) Mathur Reena (1998). Animal behavior. Rastogi Publications, Meerut.
- (4) Eugene Odum Gray W. Barrett (2005) Fundamentals of ecology 5th edition Cengage publisher. (Add place)

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Acquire knowledge on the ecological concept and basis of animal behavior.	K1
CO2	Understand the components functions and dynamics of ecosystem and populations and various animal behaviors	K2
CO3	Illustrate the significance of each environmental parameter and choose relevant steps to solve environmental issues.	K3
CO4	Analyze the environmental parameters in ecosystems and its relations with biotic factors in developing various adaptations.	K4
CO5	Design remedial measures for ecological issues conduct experiments to demonstrate animal behaviour.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	4	4	3	3	2	2
CO2	4	2	3	3	4	3	2
CO3	3	3	4	4	3	3	3
CO4	4	2	3	3	4	3	2
CO5	3	3	4	4	3	3	3
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 3x10=30
	5x5 = 25	

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GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER-IV
LABORATORY TECHNIQUES IN
ZOOLOGY IV – PRACTICAL

CODE:

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Practical	6	-	-	3	40	60	100

Course Contents

APPLIED ECOLOGY

1. Maintenance of microcosms.
2. Estimation of pH, dissolved oxygen, Salinity and free CO₂ in water.
3. Determination of carbohydrates and bicarbonates in water.
4. Estimation of chlorides and total dissolved solids in water.
5. Enumeration of planktons.
6. Visit to drinking water treatment plant
7. Visit to nearest Forest ecosystem.
8. Study of a pond ecosystem – Mahamaham tank and write a report on its biodiversity.
9. Effect of pollutants on primary productivity.

SPOTTERS

Secchi disc, Water analyzer.

ETHOLOGY

1. Observation of habituation in *Pilglobosa*.
2. Observation of photo taxis in earthworms.

BIODIVERSITY

1. Calculation of Shannon index
2. Calculation of plankton biodiversity.

Field visits: To visit relevant University/Laboratories/Incubation Centre/Eco systems for Core or Elective Courses

TextBooks:

Jayasuriya, D.Fatima, R.P.Meyyan, S.Prasannakumar, A.Mani, A.Mariakuttikan, N.Arumugam, L.M.Narayanan, K.Nallasingam, V.Kumaresan, A.M.Selvaraj. 2017. Practical Zoology-Vol-3. Saras publication, Nagercoil, Tamilnadu.
Ajoy Paul, Practical Zoology. Books & Allied Pvt. Ltd. Kolkata.
P.S.Verma and P.C.Srivastava, 2020. Advanced Practical Zoology, S Chand and Company Ltd. New Delhi.

Booksforreference:

- 1.SudhaGarg, Cell biology and Cytogenetics lab, Practical Zoology I, PragatiPrakashan, 2023.
2. Yadav& Varshney, 2021. Modern Practical Zoology-1. KedarNath Ram Nath, Meerut.

Course Outcomes: On completion of the course, students will be able to:		Level
CO1	Acquire the knowledge of are the environmental factors of an aquatic ecosystem practically.	K1
CO2	Understand the principle behind the protocols adopted for analysis of ecosystem.	K2
CO3	Apply the concepts of ecology in field studies and analysis.	K3
CO4	Analysis the data and different biotic and abiotic factors of an ecosystem.	K4
CO5	Assess the data and draw conclusion based on the interpretations of data.	K5 &K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	4	4	4	4	2	3	3
CO2	3	4	3	4	3	3	2
CO3	4	4	4	4	4	3	2
CO4	4	3	4	3	4	2	3
CO5	2	4	2	3	4	2	2
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3Medium-2 Low- 1

Question pattern:

Section A	Section B	Section C
1 X 20 =20	2X 10 = 20	Record = 5 Spotters = 10 Viva = 05

[Signature]

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM
DEPARTMENT OF ZOOLOGY
M.SC., ZOOLOGY
OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER-IV **ELECTIVE COURSE-VI**
CODE: STEM CELL BIOLOGY

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT I:

Introduction to stem cell biology: Stem cell definition, origin and hierarchy, stem cell properties, Identification and Characterization, potency and differentiation, niche of stem cell, overview of different stem cell types (embryonic stem cells, adult stem cells and induced pluripotent stem cells).

UNIT II:

Embryonic stem (ES) cell: Characterization and properties of ES cells, pluripotency and self-renewal of ES cells; molecular mechanisms regulating pluripotency and maintenance of the stem state, progressive differentiation of ES cells into ectoderm lineage organs (skin, brain and nerve), mesoderm lineage organs (heart, kidney, muscle, bone and blood), and endoderm lineage organs (lung, liver, stomach, pancreas and intestine).

UNIT III:

Adult stem cells: Mesenchymal stem cells (MSCs) - sources, properties (plasticity, homing and engraftment), potency and characterization; Haematopoietic stem cells (HSCs) - sources, properties, potency and characterization; steps involved in production of induced pluripotent stem cells (iPSCs); role of Yamanaka factor in iPSCs.

UNIT IV:

Stem cell and aging: aging theory; cell cycle; telomere and telomerase; senescence of stem cell; role of stem cell in aging; tissue repair and regeneration of adult stem cell.

UNIT V:

Current stem cell therapies: Advantages and disadvantages of ES cells and adult stem cells (MSCs and HSCs) therapy; Ethical concern on stem cell therapy; current stem cell therapy for various diseases; clinical outcome of stem cell therapy; state of clinical trials in adult stem cells for various diseases.

TextBooks:

1. Kiessling, A.A. 2006. Human Embryonic Stem Cells (Second Ed.), Jones & Barlett Publishers.
- (2) Lanza, R. and A. Atala. 2005. Essentials of Stem Cell Biology. Academic Press, pp-712.
- (3) Turksen, K. 2004. Adult Stem Cells. Humana Press, Inc, pp-429.

Books for reference:

1. Quesenberry, P.J., G.S. Stein, B. Forget and S. Weissman. 2001. Stem Cell Biology and Gene Therapy. Wiley Publishers, pp-584.
2. Sell, S. and Totowa, N.J. 2004. Stem Cells Handbook, Humana Press, pp-534.
3. Sullivan, S., C. A. Cowan and K. Eggan. 2007. Human Embryonic Stem Cells: The Practical Handbook. Wiley Publishers, pp-424.

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	Master the theoretical knowledge of various field stem cell biology.	K1
CO2	Understand the basic knowledge of stem cells and their origin	K2
CO3	Apply the knowledge in stem cell therapy	K3
CO4	Acquire and perform various experiment-related aspects of stem cell biology.	K4
CO5	Understand and apply the current stem cell therapies for their research	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	3	1	1	3
CO2	2	2	3	3	1	1	3
CO3	3	2	1	3	1	1	3
CO4	2	2	1	3	1	1	3
CO5	1	2	1	2	2	1	3
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3 Medium-2 Low- 1

Question pattern:

Section A		Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 5x5 = 25	1 question from each unit 3x10=30

Obhaya

OUTCOME BASED EDUCATION CHOICE BASED CREDIT SYSTEM
SEMESTER-IV ELECTIVE COURSE-V I
CODE: BIOINSTRUMENTATION

Category	Hours			Credits	Marks		
	Lecture	Tutorial	Practical		CIA	External	Total
Theory	5	-	-	3	25	75	100

Course Contents

UNIT I: Good Laboratory Practices: Guide lines, Laboratory symbols; Cleaning and sterilization of labware and reagents; handling and care of laboratory animals; Laminar flow hood: types and use; Concepts of molecular weight, atomic weight, preparation of solutions of a particular molarity and percentage; Buffers: definition and preparation of buffers, pH meter; Safety and ethical issues in laboratory settings
UNIT II: Microscopy - Light microscope, SEM. TEM. Atomic force microscope; Cryopreservation - principle and procedure; Fluorescence activated cell sorting; X-ray crystallography.
UNIT III: Centrifugation-working principle and types of centrifugation; Spectrophotometry: Mass spectrometry: Chromatography - principle and types of chromatography
UNIT IV: Biomedical Instrumentation: ESR measurement, haemoglobin measurement, blood pressure, blood flow, ECG, cardiac pacemakers; X- ray imaging, CT scan and NMR imaging; Ultrasound imaging; medical applications of laser; Biosensors - glucose biosensor, alcohol biosensor, artificial retina, environmental biosensors, cantilever-based biosensors, DNA biosensor.
UNIT V: Molecular Techniques: Isolation of DNA, RNA and proteins; Electrophoresis of DNA and proteins; Polymerase chain reaction; ELISA: Immunofluorescence; Fluorescent in situ hybridization; Southern and Western blotting.

TEXTBOOKS:

1. Sabari Ghosal and Anupama Sharma Avasthi, 2018. Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Ed., Phi Learning Pvt. Ltd., New Delhi, India.
2. Veerakumari L., 2015. Bioinstrumentation, MJP Publishers, Chennai, India.
3. Prakash Singh Bisen, Anjana Sharma, 2012. Introduction to Instrumentation in Life Sciences, CRC Press, Taylor & Francis Group, New York, USA

Books for reference: 1. Sue Carson, Heather Miller, Melissa Srougi and Scott Witherow, 2019. (2) Molecular Biology Techniques: A Classroom Laboratory Manual, Academic Press, New York, USA. (3) Aysha Divan, Janice Royds, 2013. Tools and Techniques in Biomolecular Science, Oxford University Press, UK. (4) Gordon M.H., Macrae R., 2012. Instrumental Analysis in the Biological Sciences, Blackie & Son Ltd., UK

Web references:

1. <https://bit.ly/3i5f1ym>
2. <https://pbiol.rsb.org.uk>

Course Outcomes : On completion of the course, students will be able to:		Level
CO1	To describe and explain the steps in the use of various biological instrumentation that are used in the study of different animal specimens.	K1
CO2	To relate the applications of biological techniques and employ them for the study of cells, tissues and genetic material.	K2
CO3	To correlate and appraise the use of specific bioinstrumentation for specific biological experiments and infer the results of such experiments.	K3
CO4	To compare the working principle of different bioinstrumentation and to summarize their applications.	K4
CO5	To devise experiments and justify them with the understanding of the underlying principles of bioinstrumentation that are ecofriendly, ethical and have national and global relevance.	K5 & K6

Mapping of Course Outcomes with Pos

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	3	3	2		
CO2	3	3	3	3	1		
CO3	3	3	3	3	1		
CO4	3	3	3	3	1		
CO5	3	3	3	3	3	1	1
Weightage							
Weighted % of Course contribution to POs							

Very strong -4 Strong-3 Medium-2 Low-1

Question pattern:

Section A	Section B	Section C
2 Multiple choice question from Each unit (10X1=10)	1 question from each unit (5X2=10)	1 (a & b) question from each unit 3x10=30
		5x5 = 25

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