D.K.M COLLEGE FOR WOMEN(AUTONOMOUS),VELLORE-1

DEPARTMENT OF ZOOLOGY

SYLLABUS FOR MASTER DEGREE COURSE IN ZOOLOGY

WITH EFFECT FROM
2024-2025

PG Department of Zoology with effect from 2024-2025
The course of study and Scheme of Examination

S. No.	Part	Category	Ins. Hrs/ Week	Credit	Title of the paper	Maximum marks		
						CIA	Sem. Exam	Total
SEMESTER I								
1	Part I	Core Paper I	7	5	Structure and Function of Invertebrates	25	75	100
2		Core Paper II	7	5	Comparative Anatomy of Vertebrates	25	75	100
3		Core Paper III	6	4	Lab course-I-Invertebrates & Vertebrates	25	75	100
4		Discipline Centric Elective-I	5	3	Molecules and their interaction relevant to Biology	25	75	100
5		Generic Elective - II	5	3	Biostatistics	25	75	100
			30	**20**		**125**	**375**	**500**
SEMESTER II								
6	Part I	Core Paper IV	6	5	Cellular and Molecular Biology	25	75	100
7		Core Paper V	6	5	Developmental Biology	25	75	100
8		Core Paper VI	6	4	Lab course-II Cell Biology and Developmental Biology	25	75	100
9		Discipline Centric Elective-III	3	3	Economic Entomology	25	75	100
10		Generic Elective – IV	3	3	Research Methodology	25	75	100
11	Part II	Skill Enhancement I	4	2	Poultry Farming	Internal Assessment		
12		Compulsory Paper	2	2	Human rights	25	75	100
13		Self study paper	-	2	Vermiculture	-	-	-
			30	**26**				**600**
SEMESTER III								

14	Part I	Core Paper VII	6	5	Genetics	25	75	100
15		Core Paper VIII	6	5	Evolution	25	75	100
16		Core Paper IX	6	5	Animal Physiology	25	75	100
17		Core Paper X	6	4	Industry Module - Medical Laboratory Techniques	25	75	100
18		Discipline Centric Elective-V	3	3	(Choose any one out of two) a)**Stem cell biology** b)Bio-Composting	25	75	100
19	Part II	Skill Enhancement II	3	2	Dairy Farming	Internal Assessment		
20		Internship/ Industrial Activity	-	2	Internship / Industrial Activity	-	-	-
			30	**26**				**500**
SEMESTER IV								
21	Part I	Core Paper XI	6	5	Immunology	25	75	100
22		Core Paper XII	6	5	Ecology	25	75	100
23		Core Project	10	7	Project with viva-voce	25	75	100
24		Elective – VI (Industry/ Entrepreneurship)20% Theory 80% Practical	4	3	(Choose any one out of two) **a) Aquaculture** b) Fishery Science	25	75	100
25	Part II	Skill Enhancement Course/ Professional Competency Skill	4	2	Animal Behaviour	Internal Assessment		
26	Part III		-	1	Extension activity	-	-	-
			30	**23**				**400**
Total			**120**	**95**				**2000**

CONSOLIDATED TABLE FOR CREDIT DISTRIBUTION

	Category of Courses	**Number of Courses**	**Credits for each courses**	**Number of Credits in each Category of courses**	**Total Credits**	**Total Credits for the Programme**
Part I	Core Theory	9	5	45	82	92(CGPA)
	Lab course	2	4	08		
		1	4	04		
	Project with viva-voce	1	7	07		
	Discipline centric/Generic centric elective	6	3	18		
Part II	Skill Enhancement	3	2	6	10	
	Human rights	1	2	2		
	Self Study Paper	1	2	2		
	Summer Internship	1	2	2	3	3(Non CGPA)
Part III	Extension actvity	1	1	1		

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1 : Demonstrate the ability to connect and apply biological knowledge to other disciplines and to integrate knowledge into their personal and professional lives. Be proficient at communication and annotation of scientific information and able to succeed in competitive examinations and interviews.
PEO 2 : Demonstrate the ability to engage in critical, independent, and creative thinking.Understand how scientific knowledge grows, and is organized, evaluated and disseminated.

PROGRAMME OUTCOMES (PO)

Upon completion of these courses the student would

PO1: Problem Solving Skill
Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.

PO2: Decision Making Skill
Foster analytical and critical thinking abilities for data-based decision-making.

PO3: Ethical Value
Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.

PO4: Communication Skill
Ability to develop communication, managerial and interpersonal skills.

PO5: Individual and Team Leadership Skill
Capability to lead themselves and the team to achieve organizational goals.

PO6: Employability Skill
Inculcate contemporary business practices to enhance employability skills in the competitive environment.

PO7: Entrepreneurial Skill
Equip with skills and competencies to become an entrepreneur.

PO8: Contribution to Society
Succeed in career endeavors and contribute significantly to society.

PO 9 Multicultural competence
Possess knowledge of the values and beliefs of multiple cultures and a global perspective.

PO 10: Moral and ethical awareness/reasoning
Ability to embrace moral/ethical values in conducting one’s life.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1 – Placement

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

PSO3 – Research and Development

Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society

To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

STRUCTURE AND FUNCTION OF INVERTEBRATES

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
I	24CPZO1A	Core - I	6	75	6	75	Nil	5

COURSE OBJECTIVES:

The main objectives of this course are:

1. To understand the concept of classification and their characteristic features of major group of invertebrates.
2. To realize the range of diversification of invertebrate animals.
3. To enable to find out the ancestors or derivatives of any taxon.
4. To know the functional morphology of system biology of invertebrates.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	**K1 & K2**
CO2	Understand the evolutionary process. All are linked in a sequence of life patterns.	**K2 & K4**
CO3	Apply this for pre-professional work in agriculture and conservation of life forms.	**K3 & K5**
CO4	Analyze what lies beyond our present knowledge of life process.	**K4 & K6**
CO5	Evaluate and to create the perfect phylogenetic relationship in classification.	**K5 & K6**

K1-Remember ; K2 –Understand ; K3 – Apply ; K4 – Analyze:**K5**-Evaluate; **K6**- Create

MAPPING WITH PROGRAMME OUTCOMES

COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	S	S	M	M	S	S
CO4	S	M	S	M	S	S	M	M	S	M
CO5	S	M	S	M	S	S	M	M	S	M

S- Strong; M – Medium ; L- Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

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

UNIT-II

Organization of coelom: Acoelomates-Porifera and Coelentrata,Pseudocoelomates-Aschelminthes, Coelomates-Annelida and Echinodermata, Locomotion: Flagella and ciliary movement inProtozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata.

UNIT-III

Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan –Corals and sponges,Filter feeding in Mollusca and Echinodermata. Respiration: Organs of respiration: Gills, lungs and trachea, Mechanism of respiration.

UNIT-IV

Excretion: Organs of excretion: Coelom, coelomoducts, Nephridia and Malphigian tubules; Mechanisms of excretion; Excretion and osmoregulation. Nervous system: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) and Mollusca (Cephalopoda).

UNIT-V

Invertebrate larvae: Larval forms of free living invertebrates- - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Nemertinea and Rotifera - Concept and significance; Organization and general characters.

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Hyman L.H.	The Invertebrata, Vol I to VI.	Mc Graw – Hill Book Co., New York.	1951
2.	Carter, G.S.A.	General Zoology of Invertebrates	Sidewick& Jackson Ltd., London.	1969.
3.	Barrington, E.J. W.	Invertebrate Structure and Functions	English Language Book Society.	1969.
4.	Marshall A.J and Williams W.D	Textbook of Zoology, Vol. I: Invertebrates	7th Edition – ELBS	1976.

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Barnes. R.D	Invertebrate Zoology	W.B. Saunders Co.,Philadelphia	1974
2.	Borradile, L.A. Eastham, L.E.S. and J.T. Saunders	The Invertebrate	Cambridge University Press	1977
3.	Moore, R.C. Lalicker, C.G. and Fisher,A.G.	Invertebrate Fossils.	Mc Graw Hill Book Co., New York	1952
4.	Gardinar, M.S.	Biology of the Invertebrates,	McGraw - Hill Book Co., New York.	1972
5.	Richard C Brusca	Invertebrate Zoology	Hardcever Publiser	2003

COMPARATIVE ANATOMY OF VERTEBRATES

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
I	24CPZO1B	Core - II	6	75	6	75	Nil	5

COURSE OBJECTIVES:

The main objectives of this course are:

1. Exemplifying the vertebrate origin and the intermediary position of Prochordates between invertebrates and vertebrates.
2. Acquires the knowledge on evolution and adaptive radiation of Agnatha andPisces.
3. Understanding knowledge about the first terrestrial vertebrates and the adaptive radiation of land animals.
4. Imparting conceptual knowledge about the animal life in the air and theirbehaviours.
5. Understanding the origin and efficiency of mammals and evolutionarychanges that occurred in the life of vertebrates.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of lifein all its forms.	**K1 & K2**
CO2	Understand the evolutionary process. All are linked in a sequenceof life patterns.	**K2 & K4**
CO3	Apply this for pre-professional work in agriculture and conservation of life forms.	**K3 & K5**
CO4	Analyze what lies beyond our present knowledge of life process.	**K4 & K6**
CO5	Evaluate and to create the perfect phylogenetic relationship inclassification.	**K5 & K6**

K1-Remember ; K2 –Understand ; K3 – Apply ; K4 – Analyze:K5-Evaluate; K6- Create

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	S	M	S	M	S	M	S
CO2	S	L	L	S	M	S	M	M	M	M
CO3	S	M	L	S	M	S	M	L	M	M
CO4	S	L	L	S	L	S	M	L	M	L
CO5	S	M	L	S	S	S	M	S	M	M

S-Strong; M – Medium ; L- Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-1

Origin of vertebrates: Concept of Protochordata; The nature of vertebrate morphology; Definition, scope and relation to other disciplines; Importance of the study of vertebrate morphology.

UNIT-II

Origin and classification of vertebrates. General structure and functions of skin and its derivatives; Glands, scales, horns, claws, nails, hoofs, feathers and hairs.

UNIT-III

General plan of circulation in various groups; Blood; Evolution of heart; Evolution of aortic arches and portal systems. Respiratory system - Characters of respiratory tissue; Internal and external respiration; Comparative account of respiratory organs.

UNIT-IV

Skeletal system - Skeletal elements of the body; Comparative account of jaw suspensorium, Vertebral column; Limbs and girdles; Evolution of Urinogenital system in vertebrate series.

UNIT-V

Sense organs: Simple receptors; Organs of Olfaction and taste; Electroreception, Nervous system: Comparative anatomy of the brain in relation to its functions; Comparative anatomy of spinal cord; Nerves-Cranial, Peripheral and Autonomous nervous systems.

TEXT BOOK

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Jolie. M	Chordate Morphology.	East West Press. Pvt, Ltd,	1968.
2.	Romer.A.S and Parson. T.S.	Vertebrate Body	W.B. Saunders Co.,Philaelphia.	1978

3.	Holstead	The Pattern of Vertebrate Evolution.	Freeman and Co. San Francisco. U.S.A.	1969
4.	Kapoor. V.C.	Theory and Practice of Animal Taxonomy.	Oxford and IBH Publishing Co., Pvt, Ltd. New Delhi	1998
5.	Kenneth V. Kardong	Vertebrates-Comparative Anatomy,Functions, Evolution, 4th Edition	Tata McGraw Hill Editions	2011

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Waterman. A.J	Chordate Structure and Function.	McMillan Co. London.	1971
2.	Hyman, L.H	Comparative Vertebrate Anatomy.	The University of Chicago Press, Chicago.	1966
3.	Young, J.2	Life of Vertebrates. Clarendon Press, Oxford.	Clarendon Press, Oxford.	1969
4.	Colbert, E.H	Evolution of Vertebrates.	John Wiley and Sons Inc, New York.	1969
5.	Hobart M. Smith	Evolution of Chordate Structure	Holt, Rinehart and Winston. Inc. New York.	1960

LAB COURSE IN INVERTEBRATES & VERTEBRATES

Semester	Subject Code	Category	Practical		Theory	Practical	Credits
			Hrs/ week	Total Hours/ Semester			
I	24CPZO11	Lab Course-I	4	60	Nil	60	4

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Understand the structure and functions of various systems in animals	**K2 & K4**
CO2	Learn the adaptive features of different groups of animals	**K1 & K2**
CO3	Learn the mounting techniques	**K2 & K3**
CO4	Acquire strong knowledge on the animal skeletal system	**K2 & K4**
CO5	Understand the structure and functions of various systems in animals	**K2 & K4**

K1- Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5**-Evaluate; **K6** – Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	M	S	S	M	S	M	S
CO2	S	M	L	S	M	S	M	M	M	M
CO3	M	M	L	S	L	S	M	L	M	M
CO4	S	S	L	S	L	S	M	L	M	L
CO5	S	S	M	L	M	S	M	S	M	M

S-Strong; M-Medium; L-Low

INVERTEBRATES

Dissection

Earthworm : Nervous system
Sepia : Nervous system
Cockroach : Nervous system (Demo)
Grasshopper : Digestive system and mouth parts (Demo)
Prawn : Appendages and nervous
Crab : Nervous system (Demo)

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. *Perna viridis*

Mounting

Honeybee :Sting Apparatus
Honeybee : Mouth parts
Cockroach :Mouthparts (Demo)
Housefly : Mouth part

CHORDATES

Study the nervous system of Indian dog shark - Dissection

1. Nervous system of *Scoliodon laticaudatus* – 5thor Trigeminal nerve (Demo)
2. Nervous system of *Scoliodon laticaudatus* – 7thor Facial nerve (Demo)
3. Nervous system of Cat fish -9th and 10th Cranial Nerves

Study of the following specimens with special reference to their salient features andtheir 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. *Belone cancila*(Flute fish)
8. *Exocoetus poecilopterus* (Flying fish)
9. *Mugil cephalus* (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

1. Weberian ossicles of cat fish

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Lal, S.S.	Practical Zoology	Rastogi Publications,	2009.
2	Iuliis G. D. and D. Pulerà,	The Dissection of Vertebrates: A Laboratory Manual.	Imprint of Elsevier Publication	2007
3	Verma, P.S	Manual of Practical Zoology: Chordates,	S. Chand Publishing Company	2000

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Preeti, G., and C. Mridula	Modern Experimental Zoology	Indus International Publication	2000
2	Sinha, J., A. K. Chatterjeee, P. Chattopadhya.	Advanced Practical Zoology	Arunabha Sen Publishers	2011

MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
I	24CPZO1C	Discipline Centric Elective-I	5	60	5	60	Nil	3

COURSE OBJECTIVES:

The main objectives of this course are:

1. Understanding fundamental properties of elements, atoms, molecules, chemical bonds, linkages and structure, composition, metabolism and functions of biomolecules.

COURSE OUTCOME:

On the successful completion of the course, student will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Learn the structure, properties, metabolism and bioenergetics of biomolecules	**K1 & K3**

CO2	Acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation	**K1 & K2**
CO3	Understand the fundamentals of biophysical chemistry and biochemistry, importance and applications of methods in conforming the structure of biopolymers	**K2 & K3**
CO4	Comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids	**K2 & K4**
CO5	Familiarize the use of methods for the identification, characterization and conformation of biopolymer structures	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	S	L	S	M	S	M	M
CO2	S	S	L	S	S	S	M	M	M	S
CO3	M	M	M	S	M	S	S	S	S	L
CO4	S	M	S	M	S	M	S	S	S	M
CO5	M	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-1

Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules and chemical bonds - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

UNIT-II

Biomolecular interactions and their properties: Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc. - Composition, structure, metabolism and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

UNIT-III

Bioenergetics and enzymology: Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes

UNIT-IV

Structural conformation of proteins and nucleic acids: Conformation of proteins (Ramachandran plot,

secondary, tertiary and quaternary structure) - Conformation of nucleic acids (A-, B-, Z-DNA), t-RNA, micro-RNA).

UNIT-V

Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Berg, J. M., J. L. Tymoczko and L. Stryer	Biochemistry	W.H. Freeman & Co., New York,	2002
2	Kuchel P.W. and G. B. Ralston	Biochemistry	McGraw Hill (India) Private Limited,UP	2008
3	McKee T. and J. R. McKee.	Biochemistry	Oxford University Press, US	2012
4	Nelson D.L. and M.M. Cox.	Principles of Biochemistry	W. H. Freeman Publishers, New York	2012.
5	Satyanarayana U. and U. Chakrapan	Biochemistry. (3rd Edition)	Books and Allied (P) Ltd	**2006**

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Buchanan, B.B., W. Gruissem and R.L. Jones.	Biochemistry and Molecular Biology of Plants.	John Wiley and Sons Ltd., UK	2015
2	Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell	Harper's Illustrated Biochemistry (26th Edition	The McGraw-Hill Companies, Inc., USA	2003
3	Palmer, T.	Enzymes	Affiliated East-West Press Pvt. Ltd., New Delhi	2004
4	Voet D. and J.G. Voet	Biochemistry. (4th Edition)	John Wiley & Sons (Asia) Pvt. Ltd.	2011

BIOSTATISTICS

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
I	24CPZO1D	Generic Elective - II	5	60	5	60	Nil	3

COURSE OBJECTIVES:

Students should be aware of importance of analysis of quantitative and qualitativeinformation from biological studies.

COURSE OUTCOME:

On the successful completion of the course, student will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Clear understanding of design and application of biostatistics relevantto experimental and population studies.	**K2 & K3**
CO2	Acquired skills to perform various statistical analyses using modern statistical techniques and software.	**K3 & K4**
CO3	Knowledge on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.	**K5 & K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Mapping with Programme Outcomes										
***COs**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	L	M	S	S	M	S	M	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	L
CO4	M	M	S	L	M	M	M	S	L	M
CO5	M	M	S	L	M	S	M	L	S	M

MS-Strong:M-Medium; L-Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

Definition, scope and application of statistics; Primary and secondary data: Source and implications; Classification and tabulation of biological data: Types and applications. Variables: Definition and types.

Frequency distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve; Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.

UNIT-II

Measures of central tendency: Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: Range, variation, standard deviation, standard error and coefficient of variation

UNIT-III

Probability: Theories and rules; Probability - Addition and multiplication theorem;Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.

UNIT-IV

Hypothesis testing: Student'*t*' test - paired sample and mean difference'*t*' tests. Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients. Regression analysis:,calculation of regression co-efficient.

UNIT-V

Analysis of variance: one way and two way classification. Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences(SPSS).

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Arora, P. N. and P. K. Malhan	Biostatistics	Himalaya Publishing House,Mumbai	1996
2	Gurumani, N	Introduction to Biostatistics	M.J.P. Publishers, Delhi,	2005
3	Das, D. and A. Das	Academic Statistics in Biology and Psychology.	AcademicPublisher, Kolkata,	2004
4	Palanichamy, S. and Manoharan, M	Statistical Methods for Biologists	PalaniParamount Publications, Tamil Nadu	1990

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Bailey, N. T. J	Statistical Methods in Biology (Third Edition)	Cambridge University Press, Cambridge	1994
2	Wayne W. Daniel.	Biostatistics:A Foundation for Analysis in the Health Sciences	John Wiley & Sons Inc, USA	1995
3	Snedecor, G. W. and W. G. Cochran	Statistical Methods (Sixth Edition	Oxford& IBH Publishing Co., New Delhi	1967
4	Pagano, M. and K. Gauvreau	Principles of Biostatistics (Second Edition)	Cengage Learning, New Delhi	2008

WEB SOURCES:

www.sciencedirect .com

www.pubmed.com

www.livescience.com

Wikipedia .org

www.journals.elsevier.com

SEMESTER II

CELLULAR AND MOLECULAR BIOLOGY

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
II	24CPZO2A	CORE-IV	6	75	6	75	Nil	5

COURSE OBJECTIVES:

The main objectives of this course are:

1.	To understand the ultrastructures and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.
2.	To realize involvement of various cellular components in accomplishing cell division.
3.	To enable a successful performance in cell biology component of CSIR-UGC NET.
4.	To understand the ultrastructures and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Understand the general concepts of cell and molecular biology.	**K2**
CO2	Visualize the basic molecular processes in prokaryotic and eukaryotic cells, especially relevance of molecular and cellular structures influencing functional features.	**K1 & K2**
CO3	Perceive the importance of physical and chemical signals at the molecular level resulting in modulation of response of	**K3 & K4**

	cellular responses.	
CO4	Updated the knowledge on the rapid advances in cell and molecular biology for a better understanding of onset of various diseases including cancer.	**K5**
CO5	Understand the general concepts of cell and molecular biology.	**K2**

K1-Remember ; K2 –Understand ; K3 – Apply ; K4 – Analyze:**K5**-Evaluate; **K6**- Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	L	L	L	S	S	S	M	M	M
CO2	M	M	M	S	S	S	S	M	S	M
CO3	S	S	S	M	M	S	M	M	L	S
CO4	M	M	S	L	S	S	L	M	S	S
CO5	S	M	M	S	S	S	S	M	S	S

*S - Strong; M - Medium; L - Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

General features of the cell: Basic structure of prokaryotic and eukaryotic cells , Protoplasm and deutroplasm,cell theory.

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, mechanism and regulation of intracellular transport,Structure and functions of Intracellular organelles:Nucleus,mitochodria,Golgi bodies, lysosomes and endoplasmic reticulum.

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 in pro- and eukaryotic cells; Genetic maps.

UNIT-IV

Cell communication and cell signaling: Membrane- associated receptors for peptide and steroid hormones. Cellular Interactions-General principles of cell communication: extracellular space and matrix, interaction of cells with other cells and non-cellular structures.

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

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	De Robertis. E.D.F. and De Robertis. E.M.F.	Cells and Molecular Biology	B.I Publications Pvt Ltd, India.	2001
2.	Lewin. B.	Genes VII	Oxford University Press, New York.	2000
3.	Shanmugam, G.	A laboratory manipulation in fish	Madurai Kamaraj University	1988
4.	De Witt	An evolutionary approach. Biology of the cell.	Saunders Company	1977
5.	Karp, G.	Cell Biology	McGraw Hill Ltd., Japan.	1979

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Howland J.L.	Cell Physiology	McMillan Publishing Co., New York	1973
2.	Avers. C.J.	Cell Biology	Van Nostrand Company, New York	1976
3.	Korenberg. A	DNA Replication	Dorothy- W.H. Freeman and Company,San Franciso	1974
4.	Hawkins, J.D	Gene Structure andExpression	Cambridge University Press, London.	1996
5.	Albert, B and Watson. J.D.	Molecular Biology of the cell.	Garland Publishing, London.	1990

DEVELOPMENTAL BIOLOGY

COURSE	Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
				Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
	II	24CPZO2B	CORE-V	6	75	6	75	Nil	5

COURSE OBJECTIVES

The main objectives of this course are:	
1.	Understand the process of gametogenesis, cleavage and gastrulation, embryonic development, extra embryonic membrane and placenta in various animals and human.
2.	Learn the principles, methods and applications of cryo-preservation of gametes and embryo.

COURSE OUT COMES

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Define the concepts of embryonic development	**K1**
CO2	Observe various stages of cell divisions under microscope	**K2 & K3**
CO3	Understand the formation of zygote	**K4**
CO4	Differentiate the blastula and gastrula stages	**K4 & K5**
CO5	Learn the distinguishing features of three different germ layersand formation of various tissues and organs	**K4**

K1-Remember ; K2 –Understand ; K3 – Apply ; K4 – Analyze:**K5**-Evaluate; **K6**- Create

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	L	S	M	L	M
CO2	S	S	S	S	S	L	S	S	S	S
CO3	S	M	S	S	S	S	S	L	L	M
CO4	S	S	S	S	S	M	S	S	S	L
CO5	S	S	S	M	S	S	S	L	L	M

S-Strong; M-Medium; L – Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

Gametogenesis: Origin of germ cells, spermatogenesis - Sperm morphology in relation to the type of fertilization, Oogenesis - Oogenesis in insects and amphibians.

UNIT-II

Fertilization: Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation in mammals, Acrosome reaction. Sperm–egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release - Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei - Post fertilization metabolic activation - Parthenogenesis

UNIT-III

Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage, Determinate and regulatory embryos, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Amphibian and Chick); Fate maps - (Amphibian and Chick).

UNIT-IV

Embryonic Development; Embryonic development of fish, formation of extra embryonic membranes in mammalian – Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives. Embryonic Induction, primary and secondary neurulation.

UNIT-V

Post embryonic development metamorphosis: Endocrine control of metamorphosis in insects- Endocrine control of moulting and growth in insects .

Regeneration: Formation of ectodermal cap and regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups.

Aging and senescences: Biology of senescences- cause of aging- mechanism involved in apoptosis. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy.

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Gilbert, B. F	Developmental Biology, VIII Ed	Sinaur Associates Inc. Publishers, Sunderland , Massachusetts USA	2006
2.	Balinsky, B.I	Introduction to Embryology. V Ed	Saunders, Toppan	1981
3.	Lewis Wolpert	Principles of Development. II Ed	Oxford University Press	2002
4.	Nakamura, O., &Sulo, J	Organizer, A milestone of a HalfCentury from Spemann	Elsevier/North Holland Biomedical Press	1978
5.	VasundaraRao	Developmental Biology - A Modern Synthesis	Oxford IBH, New Delhi.	1994
6.	Russo, V.E.A., Brody, S., Cove, D and Ottolenghi, S	Development. The Molecular Genetic Approach	Springer Verlag, Berlin	1992
7.	N.Arumugam	A Text book of Developmental Biology	Saras publication	2014

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Dr. A. Subramanian	Development biology	Springer	2012
2.	A.K. Rathoure	Understanding embroyological origins	Brillion publishers	2017
3.	K.S. Madhavan	Developmental biology	Wave books publishers	2017
4.	Manuel mari	Beffa kay experiment in practical development biology	Cambridge university press	2005
5.	Oppenheimer, S.B	Introduction to Embryonic Development	Allyn and Bacon,Inc. U.S.A.	1980

WEB SOURCES:

www.sciencedirect .com

www.pubmed.com

www.livescience.com

Wikipedia .org

www.journals.elsevier.com

LAB COURSE IN CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY

Semester	Subject Code	Category	Practical		Theory	Practical	Credits
			Hrs/ week	Total Hours/ Semester			
II		Lab course-II	4	60	Nil	60	4

COURSE OBJECTIVES

The main objectives of this course are:

1.To understand the developmental stages of frog.
2.To analyse the C.S of heart ,kidney lens ,limb of chick and uterine cycles in rat.
3.To observe and identification of microorganisms in pond water.
4.To understand the bacterial staining methods and identification of parasitic protozoans.
5.To analyse the preparation techniques of culture medium for bacterial growth.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Acquire knowledge to differentiate the cells of various livingorganisms and become awares of physiological processes of cells e.g. cell divisions, various stages of fertilization and embryodevelopment.	**K2**
CO2	Understand and observe as well as correctly identify different celltypes, cellular structures using different microscopic techniques.	**K3**
CO3	Develop handling - skills through the wet-lab	**K6**

	course.	
CO4	Learn the method of culturing of *Drosophila* and identification oftheir wild and mutant strains	**K1 &K2**
CO5	Acquire skills to perform human karyotyping and chromosomemapping to identify abnormalities	**K1 &K2**

K1-Remember ; K2 –Understand ; K3 – Apply ; K4 – Analyze
K5 - Evaluate; **K6** – Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	S	L	L	M
CO2	S	S	S	S	S	M	M	M	M	M
CO3	S	S	M	S	S	L	S	M	L	M
CO4	M	M	L	M	L	M	M	S	M	L
CO5	S	S	M	L	S	M	L	S	S	S

*S-Strong; M-Medium; L – Low

CELL AND MOLECULAR BIOLOGY

1. Determination of cell size using micrometer
2. Mitosis in root meristematic cells of plants
3. Identification of various stages of meiosis in the testes of grasshopper(Demo)
4. Detection of polytene chromosome in salivary gland cells of the larvae of theChironomus.
5. Detection of sex chromatin.
6. Isolation of genomic DNA from eukaryotic tissue(Demo)
7. Isolation of total RNA from bacterial cells/tissues(Demo)
8. Agarose gel electrophoresis of DNA
9. SDS-Polyacrylamide gel electrophoresis

DEVELOPMENTAL BIOLOGY

Gametogenesis - Observation of gametes from gonadal tissue sections

i. Oogenesis:Section through ovary of shrimp, fish, frog and mammals
ii. Spermatogenesis: Section through testis of shrimp, fish, calotes and mammals Fertilization (Demonstration)
iii Induced spawning in polycheate worm *Hydroids elegans*
iv *In vitro* fertilization and development in a polycheate worm *Hydroids elegans*
v Observation of egg developmental stages in *Emerita emeritus*

Embryogenesis

vi Observation and whole mount preparation of the chick blastoderm - 18 hours of development

Vii-Chick embryonic stage - 24hours of development

viii Chick embryonic stage - 48hours of development

ix Gametogenesis - Observation of gametes from gonadal tissue sections

i-Oogenesis:

- ✓ Section through ovary of mammals
- ✓ ii Spermatogenesis:
- ✓ Section through testis of shrimp, fish, calotes and mammalsFertilization (Demonstration)

Iii-Induced spawning in polycheate worm *Hydroids elegans(Demo)*

iV-In vitro fertilization and development in a polycheate worm *Hydroids elegans(Demo)*

V-Observation of egg developmental stages in *Emerita emeritus*

Embryogenesis

Vi-Observation and whole mount preparation of the chick blastoderm - 18 hours of development

vii Chick embryonic stage - 24hours of development

viii Chick embryonic stage - 48hours of developmentix

ix-Chick embryonic stage - 72hours of development

X -Chick embryonic stage - 96hours of development

Histological observation: Section through various developmental stages in chick embryo

Experimental Embryology (Demonstration)

Regeneration in Frog Tadpoles

xi Blastema formation

xii Demonstration of regenerative process in tadpoleMetamorphosis

xiii Demonstration of metamorphosis in Frog Tadpole using exogenous IodineCryopreservation

xiv Demonstration of cryopreservation of gametes of fin fish/shell fish

ECONOMIC ENTOMOLOGY

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
II	24CPZO2C	Discipline Centric Elective-III	4	60	4	60	Nil	3

COURSE OBJECTIVES:

The main objectives of this course are

1.Students should acquire a fairly good understanding about the life of insects and their classification.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Understand taxonomy, classification and life of insects in the animal kingdom.	**K1 & K2**
CO2	Know the life cycle, rearing and management of diseases of beneficial insects.	**K2 & K3**
CO3	Know the type of harmful insects, life cycle, damage potential and management of pests including natural pest control	**K2 & K3**
CO4	Recognize insects which act as vectors causing diseases in animals and human.	**K2 & K4**
CO5	Overall understanding on the importance of insects in human life.	**K2 & K6**

Knowledge Level : K1-Remember ; K2 –Understand ; K3 – Apply ; K4 – Analyze

K5 - Evaluate; K6 -Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	S	M	M	M	S	L	M
CO2	S	S	M	S	S	S	S	S	S	L
CO3	S	M	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	M	M
CO5	S	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-1

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 - Integrated pest management .

UNIT-V

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

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	William S. Romoser and John G. Stoffolano.W.	The Science of Entomology	C.Brown Publishers, England	1994
2.	Yataro Tazima, Kodarsha	The silkworm	Scientific Book Ltd., Japan	1978
3.	Ananthakrishnan, T.N	Insect Plant Interactions	Oxford and I.B.H, New Delhi.	2002
4.	P.G.Fenemore, Alkaprakash	Applied Entomology	Wiley Eastern Ltd., Delhi	1992
5.	Nayar, K.K., Ananthakrishnan, T.N. and B.V.David	General and Applied Entomology	Tata McGraw Hill Publications, New Delhi.	1989
6.	Larry P.Pedigo	Entomology and Pest Management	Prentice Hall, New Jersey.	1989
7.	Richards, O.W. and Davies, R.G	General Text Book of Entomology Tenth Edition. Vol I and II	R.I Publications, New Delhi.	1997

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	T.V. Prasad	Hand Book Of Entamoly Third Edition	New Vishal Publication	2014
2.	D.S.Reddy	Applied Entamoly New Revised Edition	New Vishal Publication	2010
3.	David B.V., Muralirangan M.C. And Meera Murali Rangan	Harmful And Beneficial Insects.	Popular Book Depot, Chennai	1992
4.	Ramakrishna Ayyar T.V	Handbook Of Economic Entomology For South India.	Books And Periodicals Supply Service, New Delhi	1989
5.	Frost S.W	General Entomology	Narendra Publishing House, Delhi	1994

RESEARCH METHODOLOGY

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
II		Generic Elective-IV	4		4		Nil	3

COURSE OBJECTIVES

- To acquire the knowledge of the Chromatography, spectroscopy
- To understand the Preparation of manuscripts and collection of data.
- To imbibe the knowledge and analysis of statistical data

.COURSE OUTCOMES:

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Understand theimplications of GLP	**K1**
CO2	Learn the working principles of different instruments	**K2**
CO3	Gain the knowledge on techniques of histology and histochemistry	**K2 & K4**
CO4	Acquire knowledge on the basic principle and application of variousmodules of light and electron microscopy	**K3 & K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**- Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	M	S	M	S	M	S	M	M
CO2	S	S	M	S	S	S	M	M	M	S
CO3	S	M	S	S	S	S	S	S	S	L
CO4	S	S	S	S	S	M	S	S	S	M
CO5	S	S	S	M	M	S	M	L	S	M

*S-Strong; M-Medium; L-Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

Good laboratory practice (GLP) - pH, Electrodes and pH meter - Colorimeter and Spectrophotometry.

UNIT-II

Histology:Organization of Cells in tissue – Epithelial tissue – Connective tissue – Muscle tissue – Nervous tissue – Mucosal tissue – Glandular tissue – Vascular tissue.

Histochemistry:

Morphological/Chemical techniques – Chemical method – physical method –biological method - fixation, embedding, sectioning and staining.

Bioinformatics:Scope and objectives – components – data, databases – Database mining tools – Application in biological sciences.

UNIT-III

Electron microscopy (TEM and SEM) - Bright field- Phase contrast - Fluorescence microscopy and Confocal microscopy

UNIT-IV

Centrifuges, Chromatography- Paper, TLC and HPLC, Electrophoresis – AGE - PAGE and SDS-PAGE, ELISA and Blotting Techniques – Northern,Sourthern and Western.

UNIT-V

Principles and Applications of tracer techniques in biology, Animal cell culturetechniques.

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Bailey, N.T. J	Statistical Method in Biology	The English Language book society and English University Press Ltd	1959
2.	Ipsen, J. and Feigl, ,P	Bancroft‘s Introduction to Biostatistics	Harper and RowPublishers, New York, London.	1970
3.	Snedecor, G. W. & William, G.	Statistical methods	Harvard University, Oxford & IBH Publication Co., Calcutta. Bombay, New Delhi	1975

4.	Sokal, R, and James, F.R.	Introduction to Bio-statistics	W.H. Freeman & Company, Toppan company, Ltd., Tokyo, Japan.	1973
5.	Anderson, Durston and Polle.	Thesis and Assignment writing	Wiley Eastern Ltd., New Delhi.	1970
6.	Comir and Peter Wood Ford	Writing scientific papers in English	Pitman Medical Publishing Co., London.	1979
7.	Palanichamy, S. and M. Shanmugavelu	Research methods in biological sciences	Palani Paramount Publications, Tamil Nadu, India.	1997

REFERENCE BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Deepak Chawla , Neena Sondhi	Concepts and Cares	2nd Edition Vikas Publications	2017
2.	Dr. Vijay & Shende Arvind	Research Methodology	S. Chand Publications	2010
3.	Pranab Kumar Banerjee	A Textbook Of Biometry	S.Chand Publication	2007
4.	Orlando Wayne	A Step By Step Approach To Biostatics	Kindle Editions Publications	2017
5.	Day, R.A	How to write and publish a scientific paper	Cambridge University Press, London.	1994

POULTRY FARMING

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
II		Skill Enhance ment I	4		4		Nil	2

COURSE OBJECTIVES

1. To understand the poultry industry based on the past , present and emphasis of future growth To study the statistical data and various functions involved in poultry industry.

COURSE OUT COMES

On the successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	To understand the various practices in Poultry farming. To know the needs for Poultry farming and the status of India in global market.	**K2 & K3**
CO2	To be able to apply the techniques and practices needed or Poultry farming.	**K1, K2 & K3**
CO3	To know the difficulties in Poultry farming and be able to propose plans against it.	**K5 & K6**

K1- Remember; **K2**- Understand; **K3**- Apply; **K4**-Analyze; **K5**-Evaluate; **K6**- Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	L	L	L	L	L	S	S	L	L
CO2	S	L	M	M	S	M	M	M	S	S
CO3	S	M	M	M	S	S	S	S	M	M
CO4	S	S	S	L	S	S	S	S	S	S
CO5	S	S	M	S	S	S	M	L	S	M

*S - Strong; M - Medium; L – Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

General introduction to poultry farming - Definition of Poultry - Past and present scenario of poultry industry in India - Principles of poultry housing - Poultry houses - Systems of poultry farming .

UNIT-II

Management of chicks - growers and layers - Management of Broilers. - Preparation of project report for banking and insurance.

UNIT-III

Poultry feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding.

UNIT-IV

Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme.

UNIT-V

Selection, care and handling of hatching eggs - Egg testing. Methods of hatching.- Brooding and rearing -. Sexing of chicks. - Farm and Water Hygiene - Recycling of poultry waste.

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Arumugam, N., Murugan, S., Johnson. and Ram Prabhu, R.	Applied Zoology	Saras Publication, Kanyakumari	2005
2	Isabel Guerrero and Legarreta	Hand Book of Poultry Science and Technology	John Wiley and Sons, New Jersey.	2010

3	Jawaid, A. and Sinha, S. P.	A Handbook of Economic Zoology	S. Chand & Company, New Delhi.	2008
4	Jabde and Pradip V	Text Book of Applied Zoology	Discovery Publishing House, Delhi	2005
5	Upadhya, V.B	Economic Zoology.	Rastogi Publications, Meerut, India.	2006

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Bell D.Donald and weaver D.William.Jr.	Commercial chicken meat and egg.Production	Springer,India Pvt Ltd.,Noida.	2007
2.	Prakash Malhotra	Economic Zoology	Adhyayna Publishers & Distributors, New Delhi.	2008
3.	Khan, A. A.	Encyclopedia of Economic Zoology. 2 vols	Anmol Publications Pvt. Ltd., New Delhi.	2007
4.	Scott, M.L., Nesheim, M.C. and Young, R.J.	Nutrition of the Chicken. 3rd ed.	Ithaca, New York.	1982
5.	Biester, H.E. and Schwarte, L.H.	Diseases of Poultry, 5th Edn	Oxford and IBH Publishing Co, New Delhi.	1969

WEB SOURCES:

www.livescience.com

www.sciencemag.com

www.treehugger.com

www.nature.com

HUMAN RIGHTS

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
II		Compulsory Paper	2	20	2	20	Nil	2

COURSE OBJECTIVE

- To enable the students to understand the Definition of Human Rights.
- To make the students to understand the Universal Declaration of Human Rights.

COURSE OUTCOMES

On the successful completion of the course the student will be able to

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Highlight the Definition of Human Rights	**K3**
CO2	State the Role of Universal Declaration of Human Rights	**K3**
CO3	Explain Human Rights Declarations	**K2**
CO4	Discuss about the International Human Rights in Domestic Courts.	**K2**
CO5	Understand about Contemporary Issues on Human Rights	**K3**

Knowledge Level : K1-Remember ;K2 –Understands ; K3 – Apply ; K4- Analyse

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	S	M
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	M
CO4	M	S	M	S	M	M
CO5	S	M	S	M	S	M

S- Strong; M- Medium; L- Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I **4 Hours**

DEFINITION OF HUMAN RIGHTS

Definition of Human Rights-Nature, Content, Legitimacy and Priority-Theories on Human Rights- Historical Development of Human Rights.

UNIT-II **4 Hours**

UNIVERSAL DECLARATION OF HUMAN RIGHTS

International Human Rights –Prescription and Enforcement till World War II – Human Rights and the U.N.O.-Universal Declaration of Human Rights-International Covenant on Civil and Political Rights –International Covenant on Economic, Social and Cultural Rights and Optional Protocol.

UNIT-III **4 Hours**

HUMAN RIGHTS DECLARATIONS

Human Rights Declarations –U.N. Human Rights Declarations – U.N. Human Commissioner.

UNIT-IV **4 Hours**

INTERNATIONAL HUMAN RIGHTS IN DOMESTIC COURTS.

Amnesty International –Human Rights and Helsinki Process-Regional Developments-European Human Rights System-African Human Rights System-International Human Rights in Domestic Courts

UNIT-V **4 Hours**

Issues on Human Rights: Children's Rights-Women's Rights– Dalit's Rights-Bonded Labour and Wages-Refugees-Capital Punishment-Fundamental Rights in the Indian Constitution-Directive Principles of State Policy-Fundamental Duties- National Human Rights Commission.

TEXT BOOKS

S.no	Authors	Title	Publishers	Year Of Publication
1	Paul Willams	The International bill of Human Rights	Entwhistle Books	1981
2	Mausice Cranston	What are Human Rights	Bodley Head	1973
3	A.R. Desai	Violation of Democratic rights in India	Popular prakashan	1986

REFERENCE BOOKS

S.no	Authors	Title	Publishers	Year Of Publication
1	Dr.J.N. Pandy	Constitutional law	Central Law Agency	2018
2	J.C. Johari	Human Rights and new World order	Anmol	1996
3	G.S. Bajwa	Human Rights in India	Anmol	1995

WEB SOURCES:

https://www.ohchr.org

https://www.aaas.org

Self Study Paper

VERMICULTURE

Semester	Subject Code	Category	Lecture		Theory		Practical	Credits
			Hrs/ week	Total Hours/ Semester	Hrs/ week	Total Hours/ Semester		
I		Generic Elective - II	5		5		Nil	3

COURSE OBJECT IVES

Students should be aware of economic and cultural importance of Vermiculture.

COURSE OUTCOME:

On the successful completion of the course, student will be able to:

CO Number	CO Statement	Knowledge Level (K1-K4)

CO1	To understand the various practices in vermiculture. To know the needs for Vermiculture and the status of India in global market.	**K2 & K3**
CO2	Able to apply the techniques and practices needed for vermiculture.	**K1, K2 & K4**
CO3	To know the difficulties in Vermiculture and be able to propose plans against it.	**K5 & K6**

K1- Remember; **K2**- Understand; **K3**- Apply; **K4**-Analyze; **K5**-Evaluate; **K6**- Create

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	M	L	L	L	L	S	L	L	L
CO2	L	S	S	S	S	S	L	S	S	S
CO3	M	S	S	S	S	S	L	S	S	L
CO4	L	S	S	S	M	S	M	S	S	M
CO5	S	S	M	S	L	L	L	M	L	M

*S - Strong; M - Medium; L- Low

DISTRIBUTION OF MARKS: THEORY 100%

UNIT-I

Earthworms - Taxonomic position, external features - shape, size, colour, segmentation, setae & clitellum. Body wall, coelom- locomotion,digestive, circulatory, respiratory, excretory & nervous system. Reproductive system-Male & Female, copulation, cocoon formation & fertilization, development of earth worm. Vermitechnology- Definition, history, growth and development in other countries & India, significance.

UNIT-II

Vermiculture - definition, common species for culture; Environmental parmeters; culture methods – wormery - breeding techniques; indoor and outdoor cultures - monoculture and polyculture - merits and demerits.

UNIT-III

Vermicomposting of wastes in field pits, ground heaps, tank method, roof shed method, static pile windrows, top fed windrows, wedges & bin method, harvesting the compost, storage.

UNIT-IV

Applications of vermiculture - Vermiculture Bio-technology, vermicomposting, use of vermicastings in organic farming/horticulture, earthworms for management of municipal/selected biomedical solid wastes; as feed/bait for capture/culture fisheries; forest regeneration.

UNIT-V

Potentials and constraints for vermiculture in India. Marketing the products of vermiculture - quality control, market research, marketing techniques – creating the demand by awareness and demonstration,

advertisements, packaging and transport, direct marketing. Economic importance of Earthworms: In sustainable agriculture, organic farming, earthworm activities, soil fertility & texture, soil aeration, water impercolation, decomposition & moisture, bait & food.

TEXT BOOKS

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Sultan Ahmed Ismai	The Earthworm Book,Second Revised Edition	Other India Press, Goa, India.	2005
2	Bhatnagar & Patla	Earthworm vermiculture and vermin-composting	Kalyani Publishers,New Delhi	2007
3	Mary Violet Christy	Vermitechnology	MJP Publishers, Chennai.	2008
4	Ismail, S.A.	Vermitechnology	The biology of earthworms, Orient Longman, India.	1997

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3	Mary Violet Christy	Vermitechnology	MJP Publishers, Chennai.	2008
4	Aravind Kumar	Verms & Vermitechnology	A.P.H. Publishing Corporation, New Delhi.	2005