Department of Zoology (UG)

Programme Specific Outcomes (PSOs)

On the successful completion of the Undergraduate programme, the students will be able to

PSO1 **Disciplinary Knowledge**	demonstrate a fundamental understanding of the academic field of Zoology, its different learning areas and applications, and its link with related disciplinary areas/subjects.
PSO2 **Communication Skills**	communicate the concepts, constructs and techniques involved with ease and in a clear manner based on the animal evolution, animal behaviour, animal development and animal ecology.
PSO 3 **Problem Solving**	acquire effective entrepreneur skills by enhancing their critical thinking, problem solving, decision making and leadership skills that will facilitate startups and can develop high potential organizations.
PSO 4 **Analytical Reasoning**	analyse the data, synthesise the findings and provide valid conclusion by critical evaluation of theories, policies and practices for the betterment of society.
PSO 5 **Research Skills**	explore and evaluate globally competent research methodologies to apply appropriately in interdisciplinary research; Develop and sustain the research capabilities to meet the emerging needs for the welfare of the society.
PSO 6 **Digital Literacy**	make use of ICT and Construct various application-oriented twigs of Zoology to become an entrepreneur by fulfilling the economic needs of their life.
PSO 7 **Leadership and Teamwork**	adapt to work in groups efficiently in diverse areas like research laboratories, industries and academic based institutions.
PSO 8 **Moral and Ethical Awareness/Reasoning**	uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment.
PSO 9 **Multicultural Competence**	apply the classic and modern biological theoretical and practical knowledge gained to address societal, health, microbial and plant biodiversity studies, safety, ethical and cultural issues and the consequent responsibilities relevant to the professional upgradation of the student and society as a whole.
PSO 10 **Self-directed & Lifelong Learning**	explore the scientific temperament and lifelong learning in the modern life science courses

Department of Zoology (UG)

Learning Outcomes- Based Curriculum Framework (LOCF)

(w.e.f 2024-2025)

Sem	Part	Course No.	Course Title	Hrs. /Wk.	Credits	Marks
1	I	24XXXNNNN	Tamil/ Hindi/French	3	2	30
1	II	24XXXNNNN	English	3	2	30
1	III CC	24ZOO1501	Invertebrata	5	5	75
1	III CC	24ZOO1401	Cell Biology	4	4	60
1	III CC	24ZOO1403	Invertebrata and Cell Biology Lab	4	4	60
1	III S	24XXXNNNN	*Offered by Botany*	5	4	60
1	IV NME	24XXXNNNN	*Non-Major Elective - I*	3	2	30
1	IV AEC	24ZOO1200	Environmental studies	3	2	30
1	V	24XXXNNNN	NSS/NCC/PED/SLP/GMP/GNS/LIB/ACH	-	-	-
			Total	**30**	**25**	**375**
2	I	24 XXXNNNN	Tamil/ Hindi/French	3	2	30
2	II	24 XXXXNNN	English	3	2	30
2	III CC	24ZOO1502	Chordata	5	5	75
2	III CC	24ZOO1402	Economic Zoology	4	4	60
2	III CC	24ZOO1404	Chordata and Economic Zoology Lab	4	4	60
2	III S	24XXXNNNN	*Offered by Botany*	5	4	60
2	IV NME	24XXXNNNN	*Non-Major Elective -II*	3	2	30
2	IV AEC	24VAL1200/ 24CHR1200	Value Education/Christian Studies	3	2	30
2	V	24XXXNNNN	NSS/NCC/PED/SLP/GMP/GNS/LIB/ACH	-	1	15
			Total	**30**	**25+1**	**375+15**
3	I	24 XXXNNNN	Tamil/ Hindi/French	3	2	30
3	II	24 XXXNNNN	English	3	2	30
3	III C	24ZOO2401	Microbiology	4	4	60
3	III C	24ZOO2403	Animal Physiology	4	4	60

3	III C	24ZOO2405	Genetics and Evolution	4	4	60
3	III C	24ZOO2407	Microbiology and Animal Physiology Lab	4	4	60
3	III S	24 XXXNNNN	*Offered by Chemistry*	5	4	60
3	IV SEC	24 XXXNNNN	*Skill Enhancement Course - I*	3	2	30
3	V	24 XXXNNNN	NSS/NCC/PED/SLP/GMP/GNS/LIB/ACH	-	-	
			Total	**30**	**26**	**390**
4	I	24 XXXNNNN	Tamil/ Hindi/French	3	2	30
4	II	24 XXXNNNN	English	3	2	30
4	III CC	24ZOO2502	Biochemistry	5	5	75
4	III CC	24ZOO2404	Environmental Biology	4	4	60
4	III CC	24ZOO2406	Biochemistry and Environmental Biology Lab	4	4	60
4	III CC	24ZOO2302	Wild Life Conservation	3	3	45
4	III S	24 XXXNNNN	*Offered by Chemistry*	5	4	60
4	IV SEC	24 XXXNNNN	*Skill Enhancement Course - II*	3	2	30
4	V	24 XXXNNNN	NSS/NCC/PED/SLP/GMP/GNS/LIB/ACH	-	1	15
			Total	**30**	**26+1**	**390+15**
5	III CC	24ZOO3601	Immunology (TcL)	6	6	90
5	III CC	24ZOO3603	Entomology (TcL)	6	6	90
5	III CC	24ZOO3605	Developmental Biology (TcL)	6	6	90
5	III DSE	24ZOO3401	*Discipline Specific Elective - I*	5	4	60
5	III GE	24 XXXNNNN	*Generic Elective - I*	4	3	45
5	IV IS	24ZOO3255	Internship*	-	2	30
5	IV SEC	24 XXXNNNN	*Skill Enhancement Course - III*	3	2	30
			Total	**30**	**29**	**435**
6	III CC	24ZOO3802	Biotechnology (TcL)	8	8	120
6	III CC	24ZOO3602	Biodiversity (TcL)	6	6	90
6	III CC	24ZOO3402	Project	4	4	60

6	III DSE	24ZOO3404	*Discipline Specific Elective - II*	5	4	60
6	III GE	24 XXXNNNN	*Generic Elective - II*	4	3	45
6	IV SEC	24ZOO3266	Professional Competency Skill	3	2	30
			Total	**30**	**27**	**405**
	Grand Total			**180**	**158+2**	**2370+30**

* Internship - Second Year Vacation (30 Hrs.)

Discipline Specific Elective (DSE)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
5	III	24ZOO3401	Molecular Biology (TcL)	5	4	60
	III	24ZOO3403	Bioinstrumentation (TcL)	5	4	60
6	III	24ZOO3404	Bioinformatics (TcL)	5	4	60
	III	24ZOO3406	Fish Farming (TcL)	5	4	60

Supportive (offered to Botany)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
3	III	24ZOO2301	Allied Zoology I	3	3	45
		24ZOO2101	Allied Zoology I Lab	2	1	15
4	III	24ZOO2304	Allied Zoology II	3	3	45
		24ZOO2102	Allied Zoology II Lab	2	1	15

Generic Elective (GE)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
5	III	24ZOO3301	Human Reproduction and Conception Control	4	3	45
	III	24ZOO3303	Food, Nutrition and Health	4	3	45
6	III	24ZOO3302	Poultry farming	4	3	45
	III	24ZOO3304	Agriculture Entomology	4	3	45

Non-Major Electives (NME)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
1	IV	24ZOO1201	Human Biology	3	2	30
	IV	24ZOO1203	Bee Keeping	3	2	30
2	IV	24ZOO1202	Forensic Biology	3	2	30
	IV	24ZOO1204	Dairy Farming	3	2	30

Skill Enhancement Courses (SEC)

Sem	Part	Course Code	Course Title	Hours/Wk.	Credits	Marks
3	IV	24ZOO2201	Aquarium Fish Keeping	3	2	30
4	IV	24ZOO2202	Medical Laboratory Techniques	3	2	30
5	IV	24ZOO3201	Ornithology	3	2	30

Mapping with POs

ZOO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
	3	3	2	2	2	3	3	2	2	3

Mapping of Courses with PSOs

Course Code	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
24ZOO1501	3	3	2	2	2	3	1	2	2	3
24ZOO1401	3	3	2	2	2	2	2	1	3	3
24ZOO1403	3	3	3	3	3	3	3	3	3	3
24ZOO1200	3	3	3	2	3	3	2	3	3	3
24ZOO1502	3	3	2	2	1	3	2	2	2	3
24ZOO1402	3	3	2	2	2	3	2	2	2	3
24ZOO1404	3	3	2	2	2	3	3	2	2	3
24ZOO2401	3	3	2	3	2	3	2	2	3	3
24ZOO2403	3	3	1	2	2	3	2	2	2	3
24ZOO2405	3	3	2	3	2	3	2	2	2	3
24ZOO2407	3	3	2	3	3	3	3	2	3	3
24ZOO2502	3	3	1	3	2	3	3	2	2	3
24ZOO2404	3	3	1	2	2	3	2	3	3	3
24ZOO2406	3	3	3	2	3	2	3	2	2	3
24ZOO2302	3	3	2	3	1	3	3	3	3	3
24ZOO 3601	3	3	3	3	3	3	3	2	2	2
24ZOO3603	3	3	3	2	3	3	3	2	2	3
24ZOO3605	3	3	3	1	1	3	1	1	1	2
24ZOO3401/ 24ZOO3403	3	3	2	3	2	3	3	2	2	3
24ZOO3255	3	3	3	3	2	3	3	3	2	3
24ZOO3802	3	3	3	3	3	2	3	2	2	3
24ZOO3602	3	3	2	2	3	3	3	3	3	3
24ZOO3402	3	3	3	3	3	3	3	3	3	3
24ZOO3404/ 24ZOO3406	3	2	3	2	3	2	3	2	3	2
24ZOO3266	3	3	3	3	3	3	3	3	3	3
Average	**3**	**2.9**	**2.3**	**2.4**	**2.3**	**2.8**	**2.5**	**2.2**	**2.2**	**2.8**

Mapping of Courses with POs

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
24ZOO1201/ 24ZOO1203	3	3	2	2	2	3	3	3	2	3
24ZOO1202/ 24ZOO1204	3	3	2	2	2	2	2	2	2	3
24ZOO2301	3	3	2	2	1	3	3	2	2	3
24ZOO2101	3	3	2	2	2	3	3	3	2	3
24ZOO2201	3	3	1	2	2	3	3	2	2	3
24ZOO2304	3	3	2	2	1	3	3	2	2	3
24ZOO2103	3	3	2	2	2	3	3	1	1	2
24ZOO2202	3	3	2	2	1	3	3	2	1	3
24ZOO3301/ 24ZOO3303	3	3	1	2	1	2	2	1	1	2
24ZOO3201	3	2	2	2	2	2	2	2	2	2
24ZOO3302/ 24ZOO3304	3	2	2	3	2	1	3	2	1	3
Average	**3**	**3**	**1.8**	**2.1**	**1.6**	**2.5**	**2.7**	**2**	**1.6**	**2.7**

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1501	**Invertebrata**	**Core**	**5**	**5**

This theory course provides basic knowledge about the general characteristic features and classification of invertebrate phyla up to class level. A specific animal will be studied in detail as a typical representative for each phylum. General topics of importance in each phylum will be taught.

Course Outcomes:

At the end of the course, students will be able to

CO1: Outline the rules of taxonomy and the principles of animal classification.

CO2: Describe the general characteristics of Porifera and Coelenterata.

CO3: Explain the body organizations and unique characters of Helminthes and Annelida.

CO4: Evaluate the general characters of Arthropoda and Mollusca.

CO5: Discuss the importance of Minor phyla and Echinodermata.

UNIT I **(15 Hours)**

Protozoa: Taxonomy - Nomenclature - classification invertebrates upto phylum with examples - Protozoa: general characteristics - classification up to class level with examples - *Paramecium* sp.–life cycle of *Plasmodium* sp. - nutrition - reproduction and protozoan diseases- locomotion in protozoa.

UNIT II **(15 Hours)**

Porifera and Coelenterata: General characteristics - classification upto class level with examples - Porifera - *Scypha* sp.- spicules - canal system. Coelenterata - *Obelia* sp.-polymorphism - asexual reproduction - biology of corals and coral reefs - Economic importance.

UNIT III **(15 Hours)**

Platyhelminthes, Aschelminthes and Annelida: General characteristics and classification upto class level with examples - Platyhelminthes - Aschelminthes - Annelida -*Taenia* sp.- parasitic adaptations - nematode parasites and diseases -*Ascaris* sp. - *Pheretima* sp. - economic importance.

UNIT IV **(15 Hours)**

Arthropoda and Mollusca: General characteristics and classification upto class level with examples - Arthropoda -*Penaeus* sp. - Mollusca -*Pila* sp. - foot and torsion - larval forms - Crustaceans - affinities of *Peripatus*.

UNIT V **(15 Hours)**

Echinodermata and Minor Phyla: General characteristics and classification upto class level with examples -*Asterias* sp. - water vascular system - larval forms - nutrition - special characteristics of Ctenophora - Ectoprocta - Endoprocta - Rotifera.

Learning Resources

Text Books

1. Ekambaranath Ayyer (2000). A Manual of Zoology, 10th Edition.
2. Jordan EL and Verma PS (1995). Invertebrate Zoology, 12th Edition. Chand & Co.
3. Kotpal RL (1992). Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Printers & Publishers Pvt Ltd
4. Ruppert and Barnes RD (2006). Invertebrate Zoology, 8th Edition. Holt Saunders International Edition, Belmont, CA: Thomson-Brooks/Cole.

References

1. Barnes RSK., Calow P., Olive PJW., Golding DW and Spicer JI (2002). The Invertebrates: A New Synthesis, 3rd Edition, Blackwell Science.
2. Barrington EJW (1979). Invertebrate Structure and Functions. 2nd Edition,
3. Parker J and Haswell (1978). A text book of Zoology Vol. I - Williams and Williams.

Websites/ e-Learning Resources

1. https://www.nationalgeographic.com/animals/invertebrates/
2. https://bit.ly/3kABzKa
3. https://www.nio.org/
4. https://greatbarrierreef.org/
5. https://www.nationalgeographic.com/animals/invertebrates/
6. https://bit.ly/3kABzKa
7. https://www.nio.org/

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	2	3	1	2	2	3
CO 2	3	3	2	2	2	3	2	2	2	3
CO 3	3	3	2	2	2	3	1	1	2	3
CO 4	3	3	2	2	2	3	2	2	2	3
CO 5	3	3	2	2	3	3	1	1	2	3
Average	3	3	2	2	2.2	3	1.4	1.6	2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1401	Cell Biology	Core	4	4

This course is designed to enable the students to learn principles and applications of tools and techniques used in cell biology. The structure and functions of cell membrane, cell organelles, phases and mechanisms involved in mitosis and meiosis. Emphasis is also given to the study of cancerous cells and apoptosis.

Course Outcomes:

At the end of the course, students will be able to

CO1: Outline cellular and membrane structures in prokaryotes and eukaryotes.

CO2: Apply microscopy to visualize cells and micro techniques to fractionate cellular components.

CO3: Discuss the structure and functions of Endoplasmic Reticulum, Golgi bodies, Lysosomes and Ribosomes.

CO4: Evaluate the structure and functions of Mitochondria and Nucleus.

CO5: Demonstrate the various phases of cell cycle, cell division, cancerous cells and apoptosis.

UNIT I **(12 Hours)**

History of cell biology- Milestones - cell theory - protoplasm theory - structure of prokaryotic and eukaryotic cells - plasma membrane - fluid mosaic model - transport mechanisms - cytoplasmic matrix.

UNIT II **(12 Hours)**

Microscopy and microtechinques: Magnification and resolving power of microscope - light - phase contrast – scanning electron microscopy – transmission electron microscopy - measurement of cells - cell fractionation - fixation - stains - staining methods.

UNIT III **(12 Hours)**

Cellular components: Ultra structure - composition - functions of endoplasmic reticulum - Golgi bodies - ribosomes -lysosomes - centriole - microtubules - microfilaments.

UNIT IV **(12 Hours)**

Mitochondria and Nucleus: Organization and functions of mitochondria - nucleus - nucleoplasm - nuclear membrane - nuclear pore complex - nucleolus - chromatin - chromosomes - giant chromosomes.

UNIT V **(12 Hours)**

Cell cycle and Cell division: Cell cycle - mitosis - meiosis - chromosomal movement. Ageing and Apoptosis. Cancer Biology - characteristics of cancer cells - types - genetic and epigenetic theories of carcinogenesis.

Learning Resources

Text Books

1. Karp G (2013). Cell Biology, 7thEdition, International Student Version, John Wiley & Sons, Inc.
2. De Robertis EDP and De Robertis EMF (1996). Cell and Molecular biology. 8th Edition. BI Waverly Pvt. Ltd. New Delhi.

References

1. Challoner J (2015). The Cell: A visual tour of the building block of life, The University of Chicago Press and Ivy Press Ltd.
2. Cooper GM and Hausman RE (2007). The cell a molecular approach. 4thEdition, ASM Press. Washington DC.
3. Verma PS and Agarwal VK (1995). Cell and Molecular Biology, 8thEdition, S. Chand & Co., New Delhi.
4. Power CB (1991). Cell Biology 3rd edition, Himalayan Publisher.

Websites/ e-Learning Resources

1. http://www.microscopemaster.com/organelles.html
2. https://bit.ly/3tXwDSB
3. https://bit.ly/3tWNpRX
4. https://bit.ly/3AuYR9M
5. https://rsscience.com/cell-organelles-and-their-functions

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	2	3	2	1	2	3
CO 2	3	3	1	3	2	3	2	1	3	3
CO 3	3	3	2	2	2	3	2	1	2	3
CO 4	3	3	1	2	2	3	2	1	3	3
CO 5	3	3	2	2	2	3	2	1	3	3
Average	3	3	1.6	2.2	2	3	2	1	2.6	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1403	Invertebrata and Cell Biology Lab	Core	4	4

The Invertebrate Laboratory helps to appreciate the diversity of Invertebrates. This course gives an insight in the preparation of permanent slides.

Course Outcomes:

At the end of the course, students will be able to

CO1: Identify the different groups of invertebrate animals by observing their external characteristics.

CO2: Discuss and display the internal organs and mount the mouthparts.

CO3: Prepare to visit different habitats and document animal diversity.

CO4: Demonstrate the preparation of permanent slides.

CO5: Examine the differences between the stages of somatic and germ cells.

Invertebrata - Laboratory Exercises

I. Major Dissection

1. Cockroach: Nervous system
2. Prawn: Appendages.

II. Minor Dissection

1. Cockroach: Digestive system
2. Snail: Digestive system

III. Mounting

1. Earthworm**:** Body setae; Pineal setae.
2. Mosquito, Honey Bee**:** mouth parts.

IV. Spotters

1. Protozoa**:** *Amoeba, Paramecium*
2. Porifera**:** *Sycon, Spongilla*
3. Coelenterata**:** *Obelia* – Colony, Corals
4. Platyhelminthes**:** *Taenia solium, Fasciola* sp.
5. Aschelminthes**:** *Ascaris* sp (Male & Female), *Wuchereria* sp
6. Annelida**:** *Nereis, Hirudinaria*
7. Arthropoda**:** Scorpion, *Limulus, Peripatus*

8. Mollusca**:** *Chiton, Pila,*
9. Echinodermata**:** *Asterias, Ophiothrix, Echinus*

V. Field study

1. Observation of Terrestrial invertebrate
2. Economically important invertebrates
3. Observation of Larval forms of Crustacean

VI. Field Visit

1. Krusadai Island, Rameshwaram
2. Hare Island, Tuticorin

Cell Biology- Laboratory Exercises

1. Light microscope – parts, function and magnification.
2. Preparation of squamous epithelial cells.
3. Drawing different stages of cells using Camera lucida.
4. Permanent slide preparation.
5. Micrometry- measurement of cells.
6. Microtomy.
7. Study of mitosis using onion root tip.
8. Study of meiosis using rhoea flower.
9. Mounting of polytene chromosomes in *Chironomous* larvae.
10. Demonstration of plasmolysis and haemolysis.

Learning Resources

References

1. Ekambaranath Ayyar and TN Ananthakrishnan (1995). A manual of Zoology Vol. I (Part 1, 2) Viswanathan S Chennai
2. Ganguly., Sinha and Adhikari (2011). Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition.
3. Lal S (2016). Practical Zoology Invertebrate, Rastogi Publications.
4. Sinha., Chatterjee and Chattopadhyay (2014). Advanced Practical Zoology, Books and Allied Ltd; 3rd revised edition.
5. Verma PS (2010). A Manual of Practical Zoology: Invertebrates, S Chand.
6. Majumdar R and Sisodia R (2018). Laboratory Manual of Cell Biology**,** Prestige Publishers, New Delhi.

7. Perlin M., Beckerson Wand Gopinath A (2017). Cell, Genetics, and Molecular Biology: A Lab Manual (First Edition), Cognella Inc., USA.
8. Chaitanya KV (2013). Cell and molecular biology: A Lab Manual, Phi Learning Pvt. Ltd., New Delhi, India.

Websites/ e-Learning Resources

1. https://nbb.gov.in
2. http://www.agshoney.com/training.htm
3. https://icar.org.in
4. http://www.csrtimys.res.in
5. http://csb.gov.in
6. https://iinrg.icar.gov.in
7. https://www.nationalgeographic.com/animals/invertebrates
8. https://alleninstitute.org/resource/mitosis-and-microscopy/

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	3	2	3	3	3	3	2
CO 4	3	3	2	2	3	3	3	3	3	3
CO 5	3	3	2	2	3	3	3	3	3	3
Average	3	3	2.6	2.6	2.6	3	3	3	3	2.8

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1201	Human Biology	NME	3	2

This course is offered to give a basic understanding of human anatomy and physiology. Functioning of digestive, respiratory, circulatory, nervous, endocrine, immune, excretory and reproductive systems will be taught.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the structure and functions of skin, skeleton and muscles.

CO2: Evaluate the nutritive value of food and the physiology of digestion.

CO3: Discuss the structure and function of heart, lungs, brain, kidney, sense organs and endocrine glands.

CO4: Compare the male and female reproductive organs and the role of sex hormones.

CO5: Outline the disorders of skin, stomach, heart, lungs and kidney.

UNIT I **(9 Hours)**

Skin, Skeleton and Muscles: Skin –structure and functions – skeleton – bones – cartilage - joints – ligaments – muscles-types – muscle contraction – skin diseases.

UNIT II **(9 Hours)**

Nutrition and Digestion: Vitamins – minerals - balanced diet - calorific value of foods. Digestive organs - secretions - digestion - absorption - gastric disorders.

UNIT III **(9 Hours)**

Respiratory and Circulatory systems: Structure and functions of lungs and heart - haemoglobin - respiratory gas exchange - blood circulation – blood components - blood groups - Tuberculosis - Atherosclerosis.

UNIT IV **(9 Hours)**

Endocrine, Nervous and Immune systems: Endocrine glands and secretions - hyper and hypo secretory disorders - structure and functions of brain - sense organs - immune system - types of immunity.

UNIT V **(9 Hours)**

Excretory and Reproductive systems: Kidney - structure and function - renal disorders - male and female reproductive organs - sex hormones.

Learning Resources

Text Book

1. Widmaier E., Raff H and Strang K (2014). Vander's Human Physiology. McGraw Hill Education, New York.

References

1. Davies A., Blakeley AGH and Kidd C (2001). Human Physiology, Churchill Livingstone, Toronto.
2. Sherwood L (2008). Human Physiology: from cells to systems.7th Edition, Brooks/Cole: Cengage Learning, Canada.

Websites/ e-Learning Resources

1. https://www.khanacademy.org/science/biology/human-biology/circulatory-pulmonary/v/the-lungs-and-pulmonary-system
2. https://www.khanacademy.org/science/biology/human-biology/circulatory-pulmonary/v/red-blood-cells
3. https://www.visiblebody.com/learn/muscular
4. https://open.umn.edu/opentextbooks/textbooks/576

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	2	2	3	2	3	2	2	3
CO 2	3	3	2	3	2	3	2	3	2	2
CO 3	3	3	3	2	2	3	3	2	2	3
CO 4	3	3	2	2	2	3	2	2	2	3
CO 5	3	3	2	3	2	3	3	2	2	3
Average	3	3	2.2	2.4	2.2	2.8	2.6	2.2	2	2.8

High correlation -3; Medium correlation -2; Low Correlation -1; No- Correlation --'-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1203	**Bee Keeping**	**NME**	**3**	**2**

This course is designed to make the students to know about scope and the importance of apiculture, bee morphology, anatomy, life cycle, honey processing, bee products, honey bee enemies and diseases. Honey properties and application in various fields are also covered.

Course Outcomes:

At the end of the course, students will be able to

CO1: Discuss the introduction and scope of apiculture.

CO2: Explain the honey bee morphology, anatomy and life cycle.

CO3: Analyse methods of honey process and bee products.

CO4: Evaluate different bee enemies and diseases.

CO5: List out properties of honey and its products.

UNIT I **(9 Hours)**

Introduction to apiculture: History of bee keeping -bee keeping in worldwide - traditional bee keeping in India - modern bee keeping - urban or backyard bee keeping - apiculture development in India - institutions involved - role of Central Honey Bee Research & Training Institute.

UNIT II **(9 Hours)**

Honey bee morphology, anatomy and life cycle: Morphology - species diversity - indigenous and exotic - identification - origin - systematics and distribution - colony life and social organization - queen- drone - worker - communication.

UNIT III **(9 Hours)**

Honey processing and bee hive products: Honey extraction and handling - quality control standards - honey testing kit - processing of honey - bee venom and royal jelly extraction - propolis.

UNIT IV **(9 Hours)**

Honeybee enemies and diseases: Bee enemies - wax moth, ants and pests - diagnosis and identification. Bacterial disease (American Foul brood) - Viral diseases (Deformed Wing Virus) - Fungal disease (Chalk brood) - Protozoan disease (Nosemeosis).

UNIT V **(9 Hours)**

Honey - its properties and application in various fields: Honey - its medicinal properties - application in various fields - other valuable byproducts of honey bees - value added honey products - properties of honey products - nutrients and composition of honey - acid content and flavour effects.

Learning Resources

Text Book

1. Ambrose DP (2004). The insect structure, function and biodiversity. Kalyani Publishers, New Delhi**.**

References

1. Ted Hooper (2010). Guide to Bees & Honey: The World's Best-Selling Guide to Beekeeping. Northern Bee Books, Oxford.
2. Morse RA and Flottum K (1998). Honey Bee Pests, Predators and Diseases. Third Edition, Wicwas Publishers, 3rd edition.
3. Cramp D (2012). The Complete Step-by-step Book of Bee keeping: A Practical Guide to Bee keeping, from Setting up a Colony to Hive Management and Harvesting the Honey. Lorenz Books, London.

Websites/ e-Learning Resources

1. https://byjus.com/biology/apiculture-beekeeping/
2. https://hbrc.ca/honey-bee-anatomy/
3. https://agritech.tnau.ac.in/farm_enterprises/fe_api_harvestingandprocessing.html
4. https://maeshoney.com/en/properties-of-honey/

CO - PO Mapping Table

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	2	3	2	3	2	3
CO2	3	3	2	3	2	3	2	3	3	2
CO3	3	2	3	2	2	3	2	2	2	3
CO4	3	2	2	2	2	3	3	3	2	3
CO5	3	2	2	3	2	3	2	3	2	3
Average	3	2.2	2.4	2.4	2	3	2.2	2.8	2.2	2.8

High Correlation -3, Medium correlation -2, Low Correlation-1, No Correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1200	Environmental Studies	AEC	3	2

This course aims to train students and to study the role of man in environment. It also gives an overview on natural resources and sustainable development. This course also instils the importance of conservation of biodiversity and climate change. It caters the need for a strong ecological citizenship and for achieving the sustainable development goals.

Course Outcomes:

At the end of the course, students will be able to

CO1: Gain in-depth knowledge on interaction between man and environment.

CO2: Describe the role of natural resources and to help in sustainable development.

CO3: Develop critical thinking for conservation of biodiversity.

CO4: Analyze values and attitudes towards climate change impacts and its mitigation.

CO5: Evaluate the role of environment issues and legislation.

UNIT I **(9 Hours)**

Man and Environment: The man-environment interaction- humans as hunter - gatherers - mastery of fire- origin of agriculture - emergence of city-states - great ancient civilizations and the environment – Indic-knowledge and culture of sustainability - middle ages and renaissance - industrial revolution and its impact on the environment - population growth and natural resource exploitation - global environmental change.

UNIT II **(9 Hours)**

Natural resources and Sustainable development: Overview of natural resources - classification - biotic and abiotic - renewable and non-renewable. energy resources- implications of energy use on the environment. introduction to sustainable development: sustainable development goals - targets - indicators and challenges.

UNIT III **(9 Hours)**

Conservation of biodiversity and Ecosystems: Biodiversity as a natural resource - Levels and types of biodiversity - Biodiversity in India and the world - Biodiversity hotspots - Species and ecosystem threat categories. Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems - Land use and land

cover change - Commercial exploitation of species - Invasive species - Fire - disasters and climate change.

UNIT IV **(9 Hours)**

Climate change: Impacts and Mitigation: Anthropogenic climate change from greenhouse gas emissions – past, present and future - projections of global climate change with special reference to temperature – rainfall - climate variability and extreme events - climate change projections for the Indian sub-continent - impacts of climate change on ocean and land systems - climate resilient development - Mitigation of climate change: greenhouse gas reduction vs. sink enhancement - concept of carbon intensity - energy intensity and carbon neutrality - decarbonizing pathways and net zero targets for the future - climate justice.

UNIT V **(9 Hours)**

Environmental issues, Legislation, Case study and Field work: Local, regional and global environmental issues - ocean acidification - degradation of water and land resources - ozone depletion - global warming - India's greenhouse gas emissions - air pollution - air quality index. life style for environment. **Case studies and field work,** environmental legislation**.**

Learning Resources

Text Books

1. Rajagopalan R (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
2. Singh JS., Singh SP and Gupta SR (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.

References

1. Adenle A., Azadi H and Arbiol J (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management.
2. Barnett J and Neill S (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions.
3. Bawa KS., Oomen MA and Primack R (2011). Conservation Biology: A Primer for South Asia. Universities Press.
4. Berrang-Ford L., Ford JD and Paterson J (2011). Are we adapting to climate change? Global Environmental Change-Human and Policy Dimensions.

5. Bhagwat and Shonil (Editor) (2018). Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
6. Krishnamurthy KV (2003). Textbook of Biodiversity, Science Publishers, Plymouth, UK
7. Pittock and Barrie (2009). Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
8. Sinha N (2020). Wild and Wilful. Harper Collins, India.
9. Varghese., Anita., Oommen., Meera Anna., Paul., Mridula Mary., Nath., Snehlata (Editors) (2022). Conservation through Sustainable Use: Lessons from India. Routledge.

Websites/ e- Learning Resources

1. https://sdgs.un.org/goals
2. www.ipcc.org
3. https://www.ipcc.ch/report/sixth-assessment-report-cycle

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**3**	**2**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**
Average	**3**	**3**	**2.6**	**2.4**	**2.6**	**3**	**1.6**	**3**	**2.8**	**3**

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1502	**Chordata**	**Core**	**5**	**5**

This course provides a general and basic understanding of chordates. It deals the diversity, adaptations, affinities, organization, comparative study and taxonomic status of chordates. Type study for each class is also included.

Course Outcomes:

At the end of the course, students will be able to

CO1: Outline and classify prochordates and chordates.

CO2: Explain the characteristics of Agnatha and Pisces.

CO3: Assess the general characteristics and adaptive features of Amphibia.

CO4: Recall the general characteristics of Reptilia and distinguish venomous and non-venomous snakes.

CO5: Classify Aves and Mammalia and elaborate their adaptations.

UNIT I **(15 Hours)**

Chordata and Prochordata: Salient features - outline classification of phylum chordata upto class level with examples - Prochordates - classification -*Amphioxus* sp., *Balanoglossus* sp. and *Ascidian* sp. - life history - affinities.

UNIT II **(15 Hours)**

Agnatha and Pisces: Classification upto orders with examples -*Petromyzon* sp. - life history - comparison between lampreys and hag fishes - S*coliodon* sp. electric organs - parental care - migration - economic importance of fishes - types of scales and fins - accessory respiratory organs.

UNIT III **(15 Hours)**

Amphibia: Origin - general characters and classification upto orders with examples - adaptive features of anura- urodela - apoda -*Rana* sp. - parental care - Neoteny in amphibia.

UNIT IV **(15 Hours)**

Reptilia: Origin – general characters and classification upto orders with examples – *Calotes* sp. –status of *Sphenodon* sp. – identification of venomous and non-venomous snakes– biting mechanisms – poison apparatus – venom – Jacobson's organ– South Indian snakes**.**

UNIT V **(15 Hours)**

Aves and Mammalia: Classification upto orders with examples – flight adaptations – migration, adaptive radiation of beaks and feet – characters of *Archaeopteryx* – *Columba sp*. – rabbit - dentition– adaptation of aquatic mammals - flying mammals – egg laying mammals – marsupials.

Learning Resources

Text Books

1. Ayyar EK and Ananthakrishnan TN (1992). Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras.
2. Ganguly., Sinha., Bharati Goswami and Adhikari (2004). Biology of animals Vol.II – New central book Agency Pvt Ltd.
3. Jordan EL and Verma PS (2013). Chordate Zoology, S. Chand & Co Ltd., Delhi.
4. Nigam HC (1983). Zoology of Chordates, Vishal Publications, Jalandhar.

References

1. Darlington PJ (2017). The Geographical Distribution of Animals 1st Edition, Academic Publisher.
2. Hall BK. and Hallgrimsson B (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
3. Hickman CP., Hickman FM and Roberts LS (1984). Integrated Principles of Zoology, 7th Edition, Times Merror /Mosby College Publication. St. Louis.
4. Kotpal RL (2014). Modern text book of Zoology Vertebrates. 3rd Edition Rastogi Publications, Meerut.
5. Newman HH (1981). The Phylum Chordata, Satish Book Enterprise, Agra.
6. Parker and Haswell (1964). Text Book of Zoology, Vol II (Chordata), AZTBS Publishers and Distributors, New Delhi.
7. Pough H (2018.) Vertebrate life, 10th Edition, Pearson International.
8. Waterman and Allyn J. *et al*., (1971). Chordate Structure and Function, Mac Millan & Co., New York.
9. Young JZ (2004). The Life of Vertebrates. 3rd Edition. Oxford University press.

Websites/ e-Learning Resources

1. https://www.youtube.com/watch?v=novdsj5XqXY
2. https://www.youtube.com/watch?v=0PMffi5xcdQ
3. https://www.youtube.com/watch?v=MA40sdt46wc

4. https://www.youtube.com/watch?v=YRvkK7HlJaU
5. https://www.youtube.com/watch?v=XS97HWSPLUQ
6. https://www.youtube.com/watch?v=gqIrdgVh6qw
7. https://www.youtube.com/watch?v=STHu4dESJH0

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	1	3	2	3	2	3
CO 2	3	3	2	2	2	3	1	1	2	3
CO 3	3	3	2	2	1	3	2	3	2	3
CO 4	3	3	2	2	2	3	1	1	2	3
CO 5	3	3	2	2	1	3	2	1	2	3
Total	15	15	10	10	7	15	8	9	10	15
Average	3	3	2	2	1.4	3	1.6	1.8	2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1402	Economic Zoology	Core	4	4

This course is designed to make the students understand the technical and commercial aspects of rearing edible freshwater fish, shrimps, cattle, pig, poultry and earthworms.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain rearing and economic importance of insects.

CO2: Assess the methods and uses of vermicomposting**.**

CO3: Outline aquaculture practices, culture methods and hatchery management.

CO4: Analyse the methods of poultry farming, diseases and control measures.

CO5: Apply the knowledge of dairy farming and its products.

UNIT I **(12 Hours)**

Economic entomology: Apiculture: species of honey bees – social organisation of honey bee – selection of bees and location for apiary – Newton's bee hive – products of bee keeping – enemies and diseases of honey bees. Sericulture: species of silkworm – life history of mulberry silkworm – rearing of silkworm – pests and diseases of silkworm. Lac Culture: life history – host plants – cultivation of lac – enemies of lac cultivation – economic importance of lac.

UNIT II **(12 Hours)**

Vermiculture: Types of earthworms – ecological classifications of earthworms – physical, chemical and biological changes caused by earthworms in the soil – natural enemies of earthworms. Vermicomposting: methods – factors affecting vermicomposting - vermiculture unit- harvesting of vermicompost – vermicast – advantages of vermicompost – vermiwash and its applications.

UNIT III **(12 Hours)**

Aquaculture: Fresh water aquaculture: carp culture – types of ponds – preparation – maintenance – harvesting and management - integrated and composite culture - prawn culture. Marine aquaculture: edible and pearl oyster culture. Ornamental fish culture: Aquarium fishes– Aquarium maintenance in home.

UNIT IV **(12 Hours)**

Poultry farming: Poultry industry in India – poultry for sustainable food production and livelihood - commercial poultry farming – nutritive value of egg and meat-

broiler management-housing and equipment – brooding - feeding and health cover of broilers - record keeping - broiler integration – layer management – brooder - grower and layer management - culling of layers - marketing of eggs and meat.

UNIT V **(12 Hours)**

Dairy farming: Dairy farming – advantages of dairying – classification of breeds of cattle – indigenous and exotic breeds – selection of dairy cattle. Breeding – artificial insemination – dairy cattle management – housing – water supply – cattle nutrition feeding standards – common contagious diseases. Milk - composition of milk – milk spoilage – pasteurization – role of milk and milk products in human nutrition.

Learning Resources

Text Books

1. Awasthi VB (2012). Introduction to General and Applied Entomology, 3rd Edition, Scientific publishers, India.
2. David B and Ananthakrishnan TN (2006). General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
3. Gupta SM (2010). Text book of fishery, Ann Backer, Mumbai.
4. Hafez ESE (1962). Reproduction in Farm Animals, Lea and Fabiger Publisher.
5. ICAR (2013). Hand book of Animal Husbandry, 4th Edition, ICAR Publication, Pusa, New Delhi.
6. Shukla and Upadhyay (2014). Economic Zoology, 5th Edition. Rastogi Publication, Meerut New Delhi.

References

1. Abishek Shukla D (2009). A Hand Book of Economic Entomology, Vedamse Books, New Delhi.
2. Banerjee GC (2006). Text book of Animal Husbandry 8th Edition Oxford and IBH Publishing Company Ltd., New Delhi.
3. Donald D Bell and William D Weaver (2002). Commercial chicken meat and egg production, Springer, New York.
4. Dunham RA (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
5. Eckles CH and Anthony EL (2001). Dairy Cattle and milk production, Biotech. Tata McGraw Hill Publishing Co. Pvt. Ltd., New Delhi.

6. Glenn Munroe (2017). Manual of on-Farm vermicomposting and vermiculture Holdanca Farms Ltd, Wallace, Nova Scotia.
7. Hanifa MA (2011). Aquatic resources and aquaculture, Dominant, New Delhi.
8. ICAR (1997). Handbook of Animal Husbandry– The Indian Council of Agricultural Research, New Delhi.
9. Jhingran AVG (1991). Fish and Fisheries of India. Hindustan Publishing Co. New Delhi.

Websites/ e-Learning Resources

1. https://bit.ly/3tXHjk8
2. https://bit.ly/3tUTHBu
3. https://bit.ly/3hVv96q
4. https://bit.ly/39nztH1
5. https://bit.ly/3CzasVO
6. https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html
7. https://bit.ly/3nYvgSF
8. http://caa.gov.in/farms.html
9. http://www.csrtimys.res.in
10. http://www.agshoney.com/training.htm

CO –PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	2	2	2	3	2	2	2	3
CO2	3	3	2	2	2	3	2	2	2	3
CO3	3	3	2	2	2	3	2	2	2	3
CO4	3	3	3	3	2	3	2	2	2	3
CO5	3	3	3	3	2	3	2	2	2	3
Average	3	3	2.4	2.4	2	3	2	2	2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1404	Chordata and Economic Zoology Lab	Core	4	4

The laboratory course is aimed to identify, describe and classify chordate specimens in the museum and in the field. It will help the students to appreciate the diversity in the animal kingdom. The learners know the modern techniques of animal rearing and values of byproducts.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the biological significance of Prochordates, Agnatha and Vertebrates.

CO2: Examine the different species of chordates in field survey.

CO3: Identify the members and rearing equipment of honeybee.

CO4: Analyse the commercial importance of fishes, cattle and poultry.

CO5: Determine the byproducts of economically important animals and their values.

Chordata - Laboratory Exercises

I. Dissections and Mountings

1. Shark – Placoid Scales.
2. Virtual Dissection - Frog

II. Museum Specimens, slides, models and charts

Biological Significance of following

1. Prochordates - *Amphioxus, Balanoglossus, Ascidian*
2. Agnatha - *Petromyzon, Myxine*
3. Chondrichthyes - *Scoliodon,* Rays
4. Osteichthyes - *Hippocampus, Echieneis,* Carps
5. Amphibia- *Ichthyophis, Rhacophorus, Bufo, Ambystoma, Axolotl*
6. Reptilia - *Chelonemydas, Chameleon, Draco,* Alligator
7. Aves - *Archaeopteryx,* Pigeon, Kingfisher
8. Mammalia – *Loris*, Bat, Platypus

Adaptive Features of following

1. Venomous and non-venomous snakes, Beaks and Claws in birds, Aquatic Mammal.

III. Field Study (any one)

1. Documentation of campus fauna diversity - Birds
2. Visit to CMFRI and Museum
3. Visit to National Park and Zoological Park.
4. Wetlands Bird Study

Economic Zoology - Laboratory Exercises

I. Demonstration

1. Identification of structural adaptations in Queen, Worker, Drone.
2. Structure of bee Newton's bee hive, queen and drone excluder.
3. Identification of commercially important fresh water fishes and shrimps.
4. Morphometric measurement of fishes.
5. Breeds of cattle – Cow and Goat.
6. Dairy products.
7. Breeds of poultry.
8. Feed formulation for poultry.
9. Identification of earthworms.
10. Rearing of silkworm.

II. Estimation

1. Nutritional values of vermicompost.

III. Field study

1. Visit to apiary, fishery, dairy, sericulture units.

Learning Resources

References

1. Ayyar E (1982). Manual of Zoology Vol.II-. S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.
2. Lal S (2009). Practical Zoology Vertebrate, Rajpal and Sons Publishing.
3. Verma PS (2000). A Manual of Practical Zoology: Chordates, S.Chand Limited.
4. Kotpal RL (2014). Modern textbook of Zoology Vertebrates. 3rd Edition Rastogi Publications, Meerut.
5. Edwards CA and Arancon NQ (2022). Biology and Ecology of earthworms. 4th Edition, Springer Science, New York.
6. Gnaanamani MR (2003). Modern Aspects of Commercial Poultry keeping, Giri Publication, Madurai, India.
7. Ismail SA (1997). Vermicology – The biology of earthworms. Orient Longman

Ltd., Chennai.

8. Jaiswal V and Jaiswal KK (2014). Economic Zoology, 2nd Edition, PHI Learning Private Ltd. Delhi.
9. Pandey K and Shukla JP (2019) Fish and Fisheries. 4th revised Edition, Rastogi Publications, Meerut, India.

Websites/ e-Learning Resources

1. https://froggy.lbl.gov/cgi-bin/dissect?en
2. https://www.youtube.com/watch?v=b04hc_kOY10
3. https://bit.ly/3CzTEy8
4. http://tolweb.org/Chordata/2499
5. https://www.nhm.ac.uk/
6. https://bit.ly/3Av1Ejg
7. http://www.agshoney.com/training.htm
8. https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html
9. https://bit.ly/3nYvgSF
10. http://www.agshoney.com/training.htm
11. https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html
12. https://bit.ly/3nYvgSF
13. https://egyankosh.ac.in/bitstream/123456789/9190/1/Experiment-9.pdf
14. https://adpcollege.ac.in/online/attendence/classnotes/files/1626242675.pdf

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO 2	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**
CO 3	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**3**
CO 4	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO 5	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**	**3**
Average	**3**	**3**	**2**	**2.4**	**2.4**	**3**	**3**	**2**	**2**	**3**

High Correlation -3, Medium correlation -2, Low Correlation-1, No Correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO 1202	Forensic Biology	NME	3	2

This course deals with the scientific methods of crime investigation. It contains collection, identification and preservation of physical evidences. The course deals on fire arms, toolmarks and impressions, finger prints, wounds. Forensic entomology, drugs and food poisons are comprehensively included.

Course Outcomes:

At the end of the course, students will be able to

CO1: Analyse the collection methods of evidences for crime investigation.

CO2: Assess the offences based on firearms, tool marks and impressions.

CO3: Explain biological techniques adopted in crime investigations.

CO4: Identify the insects of forensic importance and explain the methods employed in forensic entomology.

CO5: Outline the classification and sources of drugs, poisons and discuss their effects on human.

UNIT I **(9 Hours)**

Introduction to forensic biology: Evidences- classification – identification – comparison – collection methods – preservation of hair – nail – fibre – paint – glass – soil - documents etc. – socio-economic offences.

UNIT II **(9 Hours)**

Fire arms, tool marks and impressions: Fire arms – bullet comparisons –collection and preservation of fire arm evidences – Tool marks – nature of marks – location of tool marks – collection and comparison of tool marks – Impressions – tyre – foot - impressions- skid marks.

UNIT III **(9Hours)**

Fingerprints, blood, wounds, lethal offences: Dermatoglyphics–Henry system - digital forensics – types of injuries - wounds and signs in offences – types of death - symptoms of death –post- mortem changes – blood stains – disputed paternity – DNA tests –case studies.

UNIT IV **(9Hours)**

Forensic entomology: Insects of forensic importance – sarcophagi – venoms and poisons – methods employed for forensic investigations – forensic lab visit.

UNIT V **(9Hours)**

Drugs and food poisons: Classification – sources of drugs, narcotics, cosmetics and abortifacients – physiological and psychological effects – withdrawal syndrome – signs of food poisoning – types of poisons – medico legal cases.

Learning Resources

Text Book

1. Parikh CK (1999). Text book of medical injuries prudence, forensic medicine and toxicology. 7th Edition, CBS Publishing and distributors, New Delhi.

References

1. Saferstein R (1978). Criminalistics, an introduction to forensic science Prentice Hall of India, New Delhi.
2. Simpson K (1979). ForensicMedicine.8th Edition, ELBS, London.

Websites/ e-Learning Resources

1. https://ncfs.ucf.edu/research/biological-evidence/
2. https://projects.nfstc.org/property_crimes/module01/pro_m01.htm#:~:text=Physical%20evidence%20consists%20of%20tangible,visible%20to%20the%20naked%20eye.
3. https://emedicine.medscape.com/article/1780557-overview
4. https://www.forensic-entomology.com/
5. https://www.forensicsciencesimplified.org/drugs/principles.html#:~:text=These%20schedules%20include%20drugs%20such,of%20a%20drug%2Drelated%20crime

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	2	2	2	3	3	2	2	3
CO 2	3	2	2	2	1	2	3	2	2	3
CO 3	3	2	2	3	3	2	2	2	2	3
CO 4	3	2	2	2	3	2	2	1	2	2
CO 5	3	2	2	2	2	2	1	1	1	2
Average	3	2	2	2.2	2.2	2.2	2.2	1.6	1.8	2.6

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO1204	Dairy Farming	NME	3	2

This course is designed with an aim to make an entrepreneur with management skills like; selection of Breed, clean milk production, health and well-being of the farm animals. It deals with the broad and comprehensive understanding of dairy management such as genetics, nutrition, reproduction, animal health, farm economics, and sustainability of dairy production systems.

Course Outcomes:

At the end of the course, students will be able to

CO1: Identify different breeds of cows & buffaloes and their breeding techniques.

CO2: Explain about the dairy houses and apply different management practices.

CO3: Discriminate the components of feed stuff and develop the skills of feeding management.

CO4: Assess the milk production and milk products.

CO5: Evaluate the symptoms of certain specific diseases in cattle.

UNIT I **(9 Hours)**

Introduction to dairy farming: Advantages - classification - indigenous and exotic breeds - selection of dairy cattle. Breeding – natural & artificial insemination.

UNIT II **(9 Hours)**

Dairy house & management: Construction - types of housing - different management parameters - winter management - summer management.

UNIT III **(9 Hours)**

Feedstuffs: Roughages –concentrate – protein - mineral supplements - vitamin supplements - feed additives - feeding management – calves feeding – adult feeding- pregnant dairy cattle feeding - feeding pregnant heifer.

UNIT IV **(9 Hours)**

Dairy sources: Milk - composition - milk spoilage - pasteurization - role of milk in human nutrition – dairy products (Cream, Butter, Cheese, Yogurt, Casein, Ghee).

UNIT V **(9 Hours)**

Contagious disease: Bacterial (*Anthrax*) - Protozoal (*Theileriosis*) - Viral (Foot and mouth) - Parasitic infestation - vaccination - biosecurity.

Learning Resources

Text Books

1. Roger W Blowey (1999). The Veterinary Books for Dairy Farmers. Old Pond Publishing Ltd; 3rd Edition.
2. Eiri Board (2008). Hand Book of Dairy Farming, Engineers India Research Institute
3. ICAR (1990). Handbook of animal husbandry TATA, S.N ed.

References

1. James N Marner (1975). Principles of dairy processing, Wiley eastern limited, New Delhi.
2. Hafez ESE (1962). Reproduction in Farm Animals, Lea and Fabiger Publisher.

Websites/ e-Learning Resources

1. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20Dairy%20unit.html
2. https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Tata,+S.N.,+ed%22

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	1	2	2	3	2	2	3
CO2	3	3	2	1	2	2	2	3	1	3
CO3	3	3	2	1	2	2	2	2	1	3
CO4	3	3	2	1	3	2	2	3	2	3
CO5	3	3	2	1	3	2	2	2	1	3
Average	3	3	2	1	2.4	2	2.2	2.4	1.4	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2401	Microbiology	Core	4	4

This course focuses on the history, scope and classification of microorganisms. It also emphasizes characteristics features, structure, classification and replication of fungi, bacteria and viruses.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Explain the history, scope and microbial taxonomy.

CO2: Describe the general characteristics of fungi and yeast.

CO3: Classify and illustrate the structure of bacteria.

CO4: Discuss the structure, characteristics, replication and cultivation of virus.

CO5: Employ microbes in various industries and environment welfare.

UNIT I **(12 Hours)**

Introduction to microbiology: History – scope - contribution of Leeuwenhoek - Jenner, Pasteur - Koch - Fleming. Evolution of microbial diversity - systematic position - five kingdom classification of Whittaker - three kingdom classification of Carl Woese. Comparison of bacteria, archaea, eukarya. Types of culture media - sterilization methods.

UNIT II **(12 Hours)**

Introductory mycology: General characteristics - outline classification of fungi - morphology of some common fungi - Mucor, Rhizopus, Aspergillus, Penicillium and Fusarium. Yeasts - general characteristics - outline classification. Lichens and Mycorrhiza - general characters.

UNIT III **(12 Hours)**

Introductory bacteriology: Classification of bacteria – significance of Bergy's Manual. Anoxygenic photosynthetic bacteria - general characteristics of purple bacteria and green bacteria - oxygenic photosynthetic bacteria - general characteristics of cyanobacteria - external and internal features - physiology and ecology. Ultrastructure of a bacterial cell – growth curve.

UNIT IV **(12 Hours)**

Introductory virology: Virus structure - classification. Positive-strand RNA viruses: Flaviviruses – Coronaviruses - Retroviruses. Negative-strand and double-strand RNA

viruses: Rhabdoviruses – Orthomyxovirus - Reovirus. DNA viruses: Herpes viruses (HSV) and Poxviruses (Smallpox). Virus Entry - replication (lytic and lysogeny) – Cultivation of viruses.

UNIT V **(12 Hours)**

Applied microbiology: Fermenters – fermented food products- kefir, tempeh and sauerkraut. Production of industrially important microbial products: antibiotics - single cell proteins - enzymes. Agricultural products: biopesticides – biofertilizers. Plant-microbial interaction: mycorrhizae - biological nitrogen fixation. Purification of water - coliform analysis.

Learning Resources

Text Books

1. Willey UM., Sherwood LM and Woolverton CJ (2011). Prescott's Microbiology. 8th Edition, Mc Graw-Hill international.
2. Brock TD and Madigan MT (2006). Biology of Microorganisms, Prentice Hall of India Private Limited.

References

1. Atlas RM (1988). Microbiology – fundamentals and applications, Macmillan Publishing Company, New York.
2. Pelczar J., Chan ECS and Krieg NR (2002). Microbiology, McGraw Hill Book Company, New York.

Websites/ e-Learning Resources

1. https://vlab.amrita.edu/?sub=3&brch=73
2. https://learn.chm.msu.edu/vibl/
3. https://mvi-au.vlabs.ac.in/
4. https://virtuallab.tlc.ontariotechu.ca/intro.php
5. https://www.merlot.org/merlot/viewMaterial.htm?id=79694
6. https://www.aaaai.org/
7. https://www.bsaci.org/

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	3	2	3	2	2	3	3
CO 2	3	3	2	3	2	3	2	2	3	3
CO 3	3	3	2	3	2	3	2	2	2	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	3	3	3	3	3	3	2	2	3
Average	3	3	2.2	3	2.4	3	2.4	2	2.6	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2403	**Animal Physiology**	**Core**	**4**	**4**

This course explores the basic physiological principles common to animals, relating structure to function. It covers the principles, mechanisms and adaptations in digestion, excretion, respiration, circulation, thermoregulation, osmo-iono regulation, muscle contraction, neuronal conduction, sensory perception, and hormonal control are discussed in detail.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Compare different types of digestion and respiration in various animals.

CO2: Discuss excretion in various animals and learn the comparative anatomy of heart structure and functions.

CO3: Analyze the adaptations of animals concerning heat and osmotic changes.

CO4: Explain the physiology of nerve conduction, and sensory organs.

CO5: Examine the regulatory actions of different endocrine glands and their hormones.

UNIT I **(12 Hours)**

Digestion and Respiration: Intracellular and extracellular - digestion and absorption of carbohydrate - protein - lipid - fat - coprophagy – cellulose digestion - hormonal control - types of respiration - pigments - transport of respiratory gases - regulation of respiration-bronchitis - asthma - effects of smoking.

UNIT II **(12 Hours)**

Circulation and Excretion: Composition and function of blood - blood coagulation - types of hearts – mammalian heart structure - heartbeat and its regulation - pacemaker – cardiac cycle – electrocardiogram - capillary circulation. Protonephridia - Metanephridia - Antennal gland - Malpighian tubules – Kidney structure - Glomerular filtration - Mechanism and regulation of urine formation.

UNIT III **(12 Hours)**

Thermal, Osmo-iono regulation and muscular physiology: Osmo regulators – Osmo conformers - stenohaline and euryhaline organisms - Osmo iono regulation in teleost. Thermoregulation – poikilotherms - homeotherms – Torpor -Hibernation –

Aestivation - Diapause. Myosin and actin filament - Mechanism of muscle contraction- Sliding filament theory - Neuro-muscular junction and reflex arc.

UNIT IV **(12 Hours)**

Neuro and Sensory Physiology: Structure - types of neurons - Action potential - Nerve impulse - Synaptic transmission - Photoreceptor - mammalian eye - Retina – Visual pigments - Physiology of vision. Phonoreceptor – structure of the mammalian ear, mechanism of hearing - Physiology of equilibrium. Chemoreceptors.

UNIT V **(12 Hours)**

Endocrine Physiology: Neuro-endocrine glands - hormones in reproduction – Endocrine glands in crustacean and insects. Hormone action - action of pituitary – thyroid – parathyroid -adrenal - pancreas and sex glands.

Learning Resources

Text Books

1. Schmidt-Nielson K (2005). Animal Physiology: Adaptation and Environment. 5th Edition. Cambridge University Press, London.
2. Verma PS., Tyagi BS and Agarwal VK (2010). Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing.
3. Sarada Subrahmanyam., Madhavan Kutty K and Singh HD (2018). Text Book of Human Physiology, S. Chand & Co, New Delhi.

References

1. Guyton AC and Hall JB (2011). Text Book of Medical Physiology, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore.
2. Ganong WF (2019). Review of Medical Physiology, McGraw Hill, New Delhi.
3. Hill WR., Wyse GA and Anderson M (2016). Animal Physiology 4th Edition. Sinauer Associates is an imprint of Oxford University Press; USA.
4. Singh HR and Kumar N (2017). Animal physiology and biochemistry, Vishal publishing company, Jalandhar.
5. Tortora GJ and Derrickson B (2016). Principles of Anatomy and Physiology, John Sons, Inc.
6. Hoar WS (1989). General and comparative physiology. Prentice Hall, New Delhi.
7. Berry AK (1998). A text book of Animal Physiology and Biochemistry. Emkay Publications, New Delhi.

8. Agarwal RA., Anil K Srivastava and Kaushal Kumar (1978). Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi Publishing.

Websites/ e-Learning Resources

1. https://www.stem.org.uk/resources/collection/3931/animal-physiology
2. https://animalphys4e.sinauer.com
3. https://nptel.ac.in/courses/102/104/102104042/

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	1	2	2	3	2	2	3	3
CO 2	3	3	1	2	2	3	2	1	2	3
CO 3	3	3	2	3	2	3	2	3	2	3
CO 4	3	3	1	1	2	3	2	1	2	3
CO 5	3	3	2	3	3	3	2	2	3	3
Average	3	3	1.4	2.2	2.2	3	2	1.8	2.4	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation -'-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2405	Genetics and Evolution	Core	4	4

This course includes the Mendelism, human genetics, chromosomal variations, pedigree analysis and inborn errors. The evolution component emphasizes on the originof life, theories and trends in evolution as well as behavioural genetics.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the Mendel's study of heredity and law

CO2: Assess the concepts in banding techniques, pedigree analysis and syndromes.

CO3: Explain the linkage, crossing over and chromosomal mapping.

CO4: Analyse the various theories of evolution.

CO5: Discuss the concepts of trends in evolution and genetic basis of behaviour.

UNIT I **(12 Hours)**

Mendelism: Mendel's study of heredity –symbols- terminology - laws – related problems - multiple alleles - gene interactions – epistasis - incomplete dominance - complementary and supplementary genes - quantitative traits - inbreeding**.**

UNIT II **(12 Hours)**

Human genetics: Mendelian traits in man - pedigree analysis - karyotype analysis– Q, G, R, C banding – chromosome variation - euploidy, aneuploidy, polyploidy - chromosomal abnormalities – Down's - Klinefelter's - Turner's - cri du chat syndrome - inborn errors of metabolism – phenylketonuria - alkaptonuria - albinism- genetic counselling – eugenics - euthenics – euphenics.

UNIT III **(12 Hours)**

Linkage and crossing over: Linkage - Linked genes -complete - incomplete linkage - Crossing over - molecular mechanisms of crossing over - kinds of crossing over models of recombination. Chromosome mapping: inference and coincidence - haploid mapping - somatic cell hybridization.

UNIT IV **(12 Hours)**

Theories of evolution: Lamarckism- Neo-Lamarckism – Darwinism- Neo-Darwinism - Germplasm theory - Mutation theory - Modern synthetic theory - Hardy Weinberg

law and its importance. Synthesis of organic molecules - Urey-Miller experiment - Origin of prokaryotes and eukaryotes.

UNIT V **(12 Hours)**

Trends in evolution and behavioural genetics: Fossils and fossilization - dating of fossils - origin of species - allopatric and sympatric speciation - genetic drift - Founder's Principle. Evolution of man and cultural evolution. Nest cleaning behaviour inhoney bees – *per* gene - Biological rhythms in Drosophila and human behaviour.

Learning Resources

Text Books

1. Snustad DP and Simmons JM (2010). Principles of Genetics 5th Edition. John Wiley & Sons Inc.
2. Stebbins GL (2017). Process of Organic Evolution. Prentice Hall, New Delhi.

References

1. Dobzansky T (1976). Genetics and the origin of species. Oxford and TBH Publishing Co., New Delhi.
2. Hexter W and Yost HT (1980). The Science of Genetics. Prentice Hall of India Pvt Ltd. New Delhi.
3. Levine L (1969). Biology of the Gene. The CV Mosby Company, St. Louis, USA.

Websites/e- Learning Resources

1. https://nios.ac.in/media/documents/SrSec314NewE/Lesson-01.pdf
2. https://iastate.pressbooks.pub/individualfamilydevelopment/chapter/evolutionary-behavior-genetics/
3. https://www.jsscacs.edu.in/sites/default/files/Department%20Files/Vidyambha%K%20N-%20Mendelism.pdf

CO - PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	2	3	2	2	2	3
CO 2	3	3	2	3	2	3	2	3	2	3
CO 3	3	3	2	3	2	3	2	2	2	3
CO 4	3	3	2	2	2	3	2	2	2	3
CO 5	3	3	2	3	2	3	2	3	3	3
Average	3	3	2	2.6	2	3	2	2.4	2.2	3

High Correlation -3, Medium correlation -2, Low Correlation-1, No Correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2407	**Microbiology and Animal Physiology Lab**	**Core**	**4**	**4**

The laboratory portion of the microbiology course is to teach microbiological techniques that will allow us to investigate the structure and physiology of microorganisms and to show students the impact of microbes on our daily lives and their central roles in nature. The animal physiology part of the laboratory course deals with animals functioning in different environments and regulating physiological processes through homeostatic mechanisms of respiration, circulation, thermoregulation, metabolism, locomotion, and osmoregulation.

Course Outcomes:

At the end of the course, students will be able to

CO1: Prepare media and culture bacteria under sterile conditions**.**

CO2: Identify bacteria and fungi using the staining technique & determine the antimicrobial susceptibility and spoilage of milk.

CO3: Analyse the experimental techniques and methods to investigate various animal physiological functions.

CO4: Explain the process of excretion and osmoregulation in animals

CO5: Examine the functions of sensory organs.

Microbiology - Laboratory Exercises

1. Principle and working of laminar flow and autoclave.
2. Sterilization methods – wet heat and dry heat sterilization.
3. Preparation of media and isolation of bacteria from water and soil.
4. Pure culture method - streak plate method.
5. Identification of bacteria using culture characteristics.
6. Gram’s staining technique.
7. Biochemical tests – IMViC, TSI, Starch hydrolysis.
8. Culturing of fungi using selective media.
9. Lactophenol cotton blue staining for fungi.
10. Kirby-Bauer method – Studying antimicrobial agents.
11. Isolation of Rhizobium from root nodules.
12. Methylene blue reduction test for Milk.

13. Industrial / Field visit.

Animal Physiology - Laboratory Exercises

1. Factors affecting salivary amylase activity (Influence of temperature and pH).
2. Estimation of oxygen consumption in fishes regarding body sizes and stress activity.
3. Respiration in terrestrial insects – Manometer technique.
4. Opercular movement in fishes: Influence of temperature and calculation of Q_{10}.
5. Identification of Blood Groups.
6. Analysis of human blood - total count of RBC.
7. Analysis of human blood - differential count of WBC.
8. Determination of heart beat and pulse rate.
9. Measurement of blood pressure and interpretation of variation.
10. Water regulation and ionic regulation in earthworm.
11. Qualitative analysis of ammonia, uric acid and urea in animals.
12. Experiments on sensory organs - vision, hearing and taste.

Learning Resources

References

1. Aneja KR (1996). Experiments in Microbiology, plant pathology, Tissue culture and Mushroom Cultivation, New Age International, New Delhi.
2. Gunasekaran P (1995). Laboratory Manual in Microbiology. New Age International Pvt. Ltd., New Delhi.
3. Schmidt-Nielson K (2005). Animal Physiology: Adaptation and Environment. 5th Edition. Cambridge University Press, London.
4. Hoar WS (1989). General and comparative physiology. Prentice Hall, New Delhi.
5. Kulshrestha W (1977). Experimental physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Siddique (1974). Experimental physiology. Oxford and IBH Pub. Co, New Delhi.

Websites/e-Learning Resources

1. https://www.youtube.com/watch?v=cneascR3OEc
2. https://www.youtube.com/watch?v=yHc359-phwA
3. https://www.youtube.com/watch?v=McINCWMbseI
4. https://faculty.washington.edu/korshin/Class-486/MicrobiolTechniques.pdf

https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC103J-lab manual.pdf

5. https://www.youtube.com/watch?v=6CqptdZyUaU

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	3	3	3	3	2	3	3
CO 2	3	3	2	3	3	3	3	2	3	3
CO 3	3	3	3	3	3	3	3	2	3	3
CO 4	3	3	2	2	3	3	3	2	3	3
CO 5	3	3	2	2	3	3	3	1	3	3
Average	3	3	2.4	2.6	3	3	3	1.8	3	3

High Correlation -3, Medium correlation -2, Low Correlation-1, No Correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2301	Allied Zoology I	Supportive	3	3

This course is an introduction to animal phyla. The theory part deals with the general characters and classification up to class level in animal kingdom. The groups Acoelomata, Pseudocoelomata, Coelomata, Prochordata, Pisces, Amphibia, Reptilia, Aves and Mammalia will be dealt with examples.

Course Outcomes:

At the end of the course, students will be able to

CO 1: Describe the diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida.

CO2: Explain the diversity and organization of Arthropoda, Mollusca and Echinodermata.

CO 3: Evaluate the taxonomic position and diversity among Protochordata, Pisces and Amphibia.

CO 4: Summarize the taxonomic position and diversity among Reptilia, Aves and Mammalia.

CO 5: Discuss the structural and functional organization of some animals.

UNIT I **(9 Hours)**

Diversity of Invertebrates–I: Principles of taxonomy - Criteria for classification – symmetry and coelom–Binomial nomenclature. Classification of Protozoa - Coelenterata - Helminthes - Annelida upto classes with two examples.

UNIT II **(9 Hours)**

Diversity of Invertebrates–II: Classification of Arthropoda - Mollusca - Echinodermata upto class level with examples.

UNIT III **(9 Hours)**

Diversity of Chordates–I: Classification of Prochordata - Pisces - Amphibia upto orders giving two examples.

UNIT IV **(9 Hours)**

Diversity of Chordates–II: Classification of Reptilia - Aves - Mammalia upto orders giving two examples.

UNIT V **(9 Hours)**

Animal organization: Structure and organization of - Earthworm - Rabbit/Rat - Prawn/Fish.

Learning resources

Text Book

1. Chaki KK., Kundu G and Sarkar S (2005). Introduction to General Zoology. Vol. I New Central Book Agency Pvt. Ltd., Kolkata, India.

References

1. Iyer E (1993). Manual of Zoology Vol. II. Viswanathan (Printers & Publishers), Chennai.
2. Jordan EL and Verma PS (2013). Chordate Zoology. S. Chand & Co Ltd., New Delhi.
3. Iyar E and Ananthakrishnan TN (1995). A Manual of Zoology: Chordata Viswanathan Publishers

Websites /e-Learning resources

1. www.sanctuaryasia.com
2. www.iaszoology.com

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10
CO 1	3	3	2	3	1	3	3	3	3	3
CO 2	3	3	2	2	2	3	3	2	2	3
CO 3	3	3	2	3	1	3	3	2	3	3
CO 4	3	3	3	2	1	3	3	2	2	3
CO 5	3	3	2	3	1	3	3	3	2	3
Average	3	3	2.2	2.4	1.2	3	3	2.4	2.4	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2101	**Allied Zoology I - Lab**	**Supportive**	**2**	**1**

This lab course is designed to familiarize the students to identify lower invertebrates and higher vertebrates. Students are trained to identify the animal models and perform dissection, mounting of various organisms.

Course Outcomes:

At the end of the course, students will be able to

CO 1: Compare lower and higher invertebrates.

CO 2: Distinguish animals with similar and dissimilar characters.

CO 3: Explain modification and adaptation of feet and beak in birds.

CO 4: Demonstrate the mounting and dissection of an animal.

CO 5: Examine mouth parts of cockroach and placoid scales in fish.

Laboratory Exercises

I. Spotters:

Protozoa (*Paramecium*, *Entamoeba)*, Porifera (simple sponge, sponge, gemmule and spicules)**,** Coelenterata (obelia colony, sea anemone). Helminthes: (liver fluke, *Ascaris*), Annelida (earthworm, leech). Arthropoda (prawn, *Peripatus*)**,** Mollusca (*Pila*, *Sepia*), Echinodermata (starfish and sea cucumber). Prochordata (*Amphioxus, Balanoglossus*, Ascidian), Agnatha (*Petromyzon)*, Pisces (*Hippocampus*, *Tilapia*). Amphibia (*Bufo*, salamander) Reptilia - Poisonous snakes (cobra, krait, and viper). Non-poisonous snakes (*Dryophis* and *Ptyas)*. Lizards: (chaemeleon and *Draco)*. Mammals (bat and loris).

II. Chart: Feet and beak adaptation in Birds.

III. Dissection: Digestive System of cockroach.

IV. Mounting: Mouthparts of Cockroach

V. Mounting: Placoid scale

Learning Resources

Text Book

1. Chaki KK., Kundu G and Sarkar S (2005). Introduction to General Zoology. Vol-1, New Central Book Agency Pvt. Ltd., Kolkata, India.

References

1. Ekambaranatha Ayyar and Ananthakrishnan TN (2000). A Manual of Zoology. Vol 1 (Invertebrata). Part II – Viswanathan Printers & Publishers, Chennai.
2. Verma PS (2021). A Manual of Practical Zoology Invertebrates, S. Chand & Co Ltd., New Delhi.

Websites/ e-Learning Resources

1. https://www.pw.live/chapter-morphology-and-anatomy-of-earthworm-cockroach-and-frog/digestive-system-of-cockroach
2. https://www.slideshare.net/slideshow/vertebrates-class/80986887
3. https://www.youtube.com/watch?v=9zKOXDDcjSQ
4. https://www.mlsu.ac.in/econtents/758_PRACTICAL%20ZOOLOGY%20%20VERTEBRATE%20(%20PDFDrive%20).pdf

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	2	2	3	3	3	2	3	3
CO 2	3	3	2	1	3	3	3	3	2	3
CO 3	3	3	2	2	2	3	3	3	1	2
CO 4	3	3	2	2	3	3	3	2	2	3
CO 5	3	3	3	1	2	3	3	3	3	2
Average	3	3	2.2	1.6	2.6	3	3	2.6	2.2	2.6

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2201	Aquarium Fish Keeping	SEC	3	2

The main objective of the course is to impart knowledge on fish culture and breeding of commercially important ornamental fishes. It gives an overview on the biology of aquarium fishes, fish feed, transportation techniques, entrepreneurship, budget and maintenance of aquarium.

Course Outcomes:

At the end of the course the students will be to

CO1: Discuss on the basic concepts and self-employment opportunity of aquarium keeping.

CO2: Describe the biology of aquarium fishes and to formulate the feeds for aquarium fishes.

CO3: Examine the factors involved in maintenance and management of aquariums.

CO4: Outline the fish transportation techniques.

CO5: Explain the different breeding techniques of ornamental fishes.

UNIT I **(9 Hours)**

Introduction and scope: Aquarium fish keeping as hobby and cottage industry. Commercial aspects like national and international market.

UNIT II **(9 Hours)**

External morphology of a fish: Exotic and endemic varieties of ornamental fishes. Culture of live food organisms- Micro worms - vinegar eel - tubifex. Artificial feed - Pellet feed formulation.

UNIT III **(9 Hours)**

Aquarium preparation and maintenance: Kinds of tanks - tank setting - biological filter and aeration - water management – planting - lighting and feeds - budget.

UNIT IV **(9 Hours)**

Common characteristic features of aquarium fishes: Guppies – Mollies - Sword tails – Platy - Siamese fighters - Gold fish - Butterfly fish - blue morph - Arowana - Angel fish.

UNIT V **(9Hours)**

Fish diseases: Nutritional diseases- lypodosis and fish scurvy. Parasitic disease -

whirling disease. Bacterial disease - Fin Rot disease. Viral disease – Lymphocystis. Protozoan disease - white spot disease. Fungal diseases - Saprolegniasis.

Learning Resources

Text Book

1. Yadav BN (2006). Fish and fisheries. 4th Edition. Daya Publishing house, Delhi.

References

1. Santhanam P., Sukumaran N and Natarajan (1987). A manual of freshwater aquaculture Reprint 1999, Oxford & IBH Pub. Company Pvt, Ltd., New Delhi.
2. Dick Mills (1987). Illustrated Guide to Aquarium Fishes. Published by Galley and Price, an imprint of W.H. Smith and Sons Limited, England.
3. Jingran VG (1991). Fish and Fisheries in India – Hindustan Publ.co. New Delhi.

Websites/ e-Learning Resources

1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004150935214277sptrivedi_MAINTENANCE_OF_FISHES.pdf
2. https://prgc.ac.in/uploads/study_material/Ornamental%20fisheriesconverted.pdf5df
3. https://www.fao.org/4/ac182e/AC182E04.htm
4. https://elearning.raghunathpurcollege.ac.in/files/4B9DCF9D16060599490.pdf

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	1	2	1	3	3	2	2	3
CO 2	3	3	2	3	1	3	3	3	2	3
CO 3	3	3	2	3	2	3	3	3	2	3
CO 4	3	3	1	2	2	3	3	2	3	3
CO 5	3	3	1	2	2	3	3	2	2	3
Average	3	3	1.4	2.4	1.6	3	3	2.4	2.2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2502	Biochemistry	Core	5	5

The course in Biochemistry is designed to impart knowledge on the mechanism and regulation of various physiological functions of living organisms. This course aims at teaching the structure of atom, chemical bonds, pH, buffers. Further the course covers aspects of structure, classification, biological functions/significance, and metabolism of carbohydrates, amino acids, proteins and lipids. The course further deals with enzymes, their classification, properties, mechanism of action, factors affecting enzyme action, co-enzymes, isoenzymes and types of enzyme inhibition.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain about pH, buffers, biologically important bonds.

CO2: Outline the classification, properties, biological importance and metabolism of carbohydrates.

CO3: Discuss the structure, classification, functions, significance and metabolism of amino acids and proteins.

CO4: Assess the biological structure, classification, significance and metabolism of lipids.

CO5: Describe the classification of enzymes, mechanism, regulation and inhibition of enzyme activity.

UNIT I **(15 Hours)**

Introduction to biochemistry: Acids – bases - dissociation constant – indicators – pH – buffers – electrolytes - isotopes. structure of an atom - biologically important chemical bonds and their role.

UNIT II **(15 Hours)**

Carbohydrates: Outline classification – isomerism - properties - biological importance. Structure of monosaccharide (Glucose) - disaccharide (Sucrose) - Polysaccharide (Starch). Carbohydrate metabolism: glycolysis – glycogenesis - glycogenolysis - citric acid cycle.

UNIT III **(15 Hours)**

Amino acids and Proteins: Amino acids - structure and classification - Protein - structure and classification -primary - secondary - tertiary structure - functions of

proteins. structure - function and significance of collagen. Protein metabolism – deamination - transamination - urea cycle.

UNIT IV **(15 Hours)**

Lipids: Structure - classification with examples – simple lipids – compound lipids – derived lipid – biological significance - lipid metabolism – β oxidation of fatty acids.

UNIT V **(15 Hours)**

Enzymes: properties and classification - mechanism of enzyme action- Coenzymes - iso-enzymes– Factors affecting enzyme action - enzyme inhibition - types.

Learning Resources

Text Books

1. Jain JL (2010). Fundamentals of biochemistry. S. Chand & Company Ltd., Ram Nagar, New Delhi.
2. Voet D and Voet JG (2004). Biochemistry. 3rd Edition. John Wiley & Sons Inc. USA.

References

1. Lehninger AC., Nelson DL and Cox MM (2001). Principles of Biochemistry. 4th Edition, W.H. Freeman Company, USA.
2. Murray RK., Granner DK., Mayes PA and Rodwell VA (2000). Harper's Biochemistry. 25th Edition. Appleton & Lange, USA.
3. Plummer DT (1996). An introduction to Practical Biochemistry. Tata McGraw Hill, New Delhi.

Websites/ e-Learning Resources

1. https://biochem.oregonstate.edu/undergraduate/educational-resources
2. https://openlearning.mit.edu/mit-faculty/residential-digital innovations/onlineresources-biochemistry-enhance-learning-well
3. https://chem.libretexts.org/Bookshelves/Biological_Chemistry/Supplemental_Modules_(Biological_Chemistry

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	1	3	2	3	3	2	2	3
CO 2	3	3	1	3	2	3	3	2	2	3
CO 3	3	3	1	3	2	3	3	2	2	3
CO 4	3	3	1	3	2	3	3	2	2	3
CO 5	3	3	1	3	2	3	3	2	2	3
Average	3	3	1	3	2	3	3	2	2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO 2404	Environmental Biology	Core	4	4

This course deals with the study of living things in relation to their environment. Starting with the structure and functions of ecosystem, types of ecosystems, population dynamics. It also deals with environmental stresses, management, various environmental pollutions and conservation of biodiversity.

Course Outcomes:

At the end of the course, students will be able to

CO1: Discuss the structure, function and diversity of ecosystem.

CO2: Analyse the importance of population regulation and biological cycle in an ecosystem.

CO3: Examine the environmental stresses and their management.

CO4: Explain the causes, effects and control measures of different forms of environmental pollution.

CO5: Evaluate the conservations of biodiversity and role of government organizations in conservation.

UNIT I **(12 Hours)**

Ecosystem: Concept - structure and function – producers - consumers – decomposers - energy flow - ecological succession - food chains - food webs - ecological pyramids. Types of ecosystems: forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II **(12 Hours)**

Population and Biological cycles: Structure and distribution – growth curves – natality - mortality - density indices - life study tables - factors affecting population growth - carrying capacity - population regulation - human population control - complete and incomplete biogeochemical cycles - sedimentary cycle.

UNIT III **(12 Hours)**

Environmental stresses and management: Global climatic pattern - global warming - atmospheric ozone - acid and nitrogen deposition – uptake – biotransformation - elimination - accumulation of toxicants - factors influencing bioaccumulation from

food and trophic transfer. Pesticides and other chemicals of: - agriculture - industry - hygiene and their disposal. Bio indicator - biomarkers of environmental health - biodegradation - bioremediation of chemicals.

UNIT IV **(12 Hours)**

Environmental pollution: Definition- cause, effects and control measures of: - air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution -nuclear hazards.

UNIT V **(12 Hours)**

Biodiversity Conservation: Biodiversity crisis – habitat degradation - poaching of wild life. Socio economic and political causes of loss of biodiversity. *in situ* and *ex situ* conservation of biodiversity - hot spots of biodiversity. Green peace movement - Chipko movement. Role of government agencies: Central and State Pollution Control Boards - Ministry of Environment and Forests- National Biodiversity Authority. Awareness programme - NGOs - natural disaster management - legislations for environmental protection - bio villages – sustainable utilization - development, Environmental ethics.

Learning Resources

Text Books

1. Odum EP and Barrett GW (2012). Fundamentals of Ecology. 5th Edition, Cengage Learning India Pvt. Ltd., Delhi, India.
2. Sharma PD (2018). Ecology and Environment,13th Edition, Rastogi Publishers, Meerut.

References

1. Batish SK (1992). Freshwater Zooplankton of India. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Stiling P (2009). Ecology: Theories and Applications. 4th Edition, PHI Learning Pvt. Ltd., New Delhi.
3. Subramanyam NS and Sambamurty AVSS (2000). Ecology. Narosa Publishing House, Chennai.

Websites/ e-Learning Resources

1. https://www.biologycorner.com/bio2/notes_chap3.html
2. https://www.slideshare.net/slideshow/advanced-ecology-notes-2020/249912203

3. https://www.yourarticlelibrary.com/notes/ecology-lecture-notes-of-ecology-and-ecosystem/11169#google_vignette

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	1	2	2	3	2	3	2	3
CO 2	3	3	1	2	2	3	2	3	3	3
CO 3	3	3	1	3	2	3	2	2	3	3
CO 4	3	3	2	2	2	3	2	3	3	3
CO 5	3	3	2	3	2	3	2	2	2	3
Average	3	3	1.4	2.2	2	3	2	2.6	2.6	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2406	**Biochemistry and Environmental Biology Lab**	**Core**	**4**	**4**

The primary objective of this course is to give students a solid foundation in biochemical and ecological principles to develop analytical, technical and critical thinking skills and to make them scientifically literate so as to contribute to the discipline after graduation.

Course Outcomes:

At the end of the course, students will be able to

CO1: Demonstrate simple laboratory instruments for carrying out practical.

CO2: Analyse the presence of carbohydrates, proteins and lipids.

CO3: Estimate BOD, COD, Calcium and Magnesium in water.

CO4: Examine the primary productivity of aquatic ecosystem.

CO5: Evaluate the ecological adaptation in animals.

Biochemistry – Laboratory Exercises

1. Colorimetry
2. Spectrophotometry
3. pH meter
4. Paper Chromatography
5. Electrophoresis
6. Centrifugation
7. Qualitative analysis of carbohydrates
8. Qualitative analysis of amino acids
9. Qualitative analysis of proteins
10. Qualitative analysis of lipids

Environmental Biology - Laboratory Exercises

I. Estimation of:

1. Dissolved oxygen
2. Carbon di oxide in water
3. Salinity in water
4. Primary Productivity of aquatic ecosystems
5. Phytoplankton and Zooplankton

II. Survey

1. Biodiversity survey in college campus
2. Survey of pollutants.

III. **Field visits**

1. Field visit to freshwater ecosystems.

Learning Resources

References

1. Plummer DT (1996). An introduction to Practical Biochemistry. Tata McGraw Hill, New Delhi.
2. Odum EP and Barrett GW (2012). Fundamentals of Ecology. 5th Edition, Cengage Learning India Pvt. Ltd., Delhi.
3. Palanivel R., Solairaj D and Chitra JP (2017). A Basic Laboratory Manual for Biochemistry, LAP Lambert Academic Publishing,
4. Umavathi Subramaniam (2022). Practical Manual on Environmental Biology and Evolution, LAP Lambert Academic Publishing

Websites/ e-Learning Resources

1. https://www.mrclab.com/biochemistry-lab-instruments
2. https://secure.caes.uga.edu/extension/publications/files/pdf/C%20992_6.PDF
3. https://komar.edu.iq/wp-content/uploads/2018/09/Lab-manual-Biochemistry.pdf
4. https://drs.nio.res.in/drs/bitstream/handle/2264/95/Zooplankton_Manual.pdf?sequence=1&isAllowed=y

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	2	2	2	3	2	3	1	3	3
CO 2	3	3	3	3	3	2	3	2	2	3
CO 3	3	2	3	2	3	2	3	1	3	3
CO 4	3	3	3	3	3	1	3	2	2	3
CO 5	2	3	2	2	3	1	3	2	1	2
Average	2.8	2.6	2.6	2.4	3	1.6	3	1.6	2.2	2.8

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2302	Wild Life Conservation	Core	3	3

The main objective of the course is to discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies.

Course Outcomes:

At the end of this course, the students will be to

CO1: Discuss the importance of wildlife, extinction and conservation approaches of wildlife.

CO2: Assess the National, international approaches for biodiversity conservation.

CO3: Explain the role PVA models, Wildlife conservation approaches, and limitations.

CO4: Analyse and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.

CO5: Evaluate the National and International strategies for wild life management and conservation.

UNIT I **(9 Hours)**

Scope and importance of wildlife of India: Causes of wildlife depletion - Economic importance - need for conservation – rare – endangered - threatened - endemic species of fishes – amphibians – reptiles - birds - mammals in India - India as a mega wildlife diversity country.

UNIT II **(9 Hours)**

Conservation of wildlife: Role of government and non-governmental organizations in conservation - in-situ - ex-situ conservation - wildlife sanctuaries -national parks - tiger reserves - biosphere reserves: Zoos: aims - formation - management - zoological parks.

UNIT III **(9 Hours)**

Theory and analysis of conservation of populations: Population viability analysis-conceptual foundation - uses of PVA models - management decisions for small populations using PVA models - minimum viable populations - recovery strategies for threatened species. Environmental Impact Assessment methods - role in wildlife conservation.

UNIT IV **(9 Hours)**

National Efforts for Conservation: Natural and artificial regeneration of forests - nursery techniques-seed technology- Silvicultural systems –Coppice and conversion system – Agro-forestry systems - Social/Urban Forestry - Joint Forest, Management - Indian Forest Act 1927 - Forest Conservation Act 1980 - Wildlife Protection Act 1972 - National and State Biodiversity Action Plans - other Forests and Environmental Acts.

UNIT V **(9Hours)**

Management of wildlife: Habitat manipulation: food – water - shade improvement - impact and removal of invasive alien species - human wildlife conflicts -basic concepts - reasons for conflicts - identification of damages caused by wild animals and control measures - basic concepts and applications of wildlife census - remote sensing in wildlife management.

Learning Resources

Text Books

1. Justice Kuldip Singh (1998). Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj Publishers, Dehradun.
2. Hosetti BB (1997). Concepts in Wildlife Management, Daya Publishing House, Delhi.
3. Sutherland WJ (2000). The conservation handbook: Research, Management and Policy. Blackwell Science.
4. Caughley G and Sinclaire ARE (1994). Wildlife ecology and management. Blackwell Science.
5. Woodroffe R., Thirgood S and Rabinowitz A (2005). People and Wildlife, Conflict or Co Existence. Cambridge University.
6. Sinha PC (1998). Wildlife and Forest Conservation, Anmol Publishing Pvt. Ltd., New Delhi.
7. Singh SK (2005). Text Book of Wildlife Management. IBDC, Lucknow.

References

1. Gilas RH (1984). Wildlife Management Techniques, 3rd Edition. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun.
2. Rodgers WA (1991). Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII.

3. Saharia VB (1982). Wildlife of India, Natraj Publishers, Dehra Dun.
4. Goutam Kumar Saha and Subhendu Mazumdar, 2017. Wildlife Biology: An Indian Prospective, PHI Publisher, Delhi.
5. Katwal and Banerjee (2002). Biodiversity conservation in managed and protected areas, Agrobios, India.
6. Gopal and Rajesh (1992). Fundamentals of Wildlife Management, Justice Home, Allahabad, India.
7. Sharma BD (1999). Indian Wildlife Resources Ecology and Development, Daya Publishing House, Delhi.
8. Stephen HB and Saharia VB (1995). Wildlife research and management. Asian and American Approaches, Oxford University Press, Delhi.
9. Negi SS (1993). Biodiversity and its conservation in India, Indus Publishing Co., New Delhi.
10. Moulton MP and Sanderson J (1997). Wildlife Issues in a Changing World. St. Lucie Press.

Websites/e- Learning Resources

1. https://bit.ly/39oPj44
2. https://bit.ly/3lHdEYJ
3. https://bit.ly/3CwBCfY
4. https://bit.ly/3EDYr3a
5. https://bit.ly/3tVtG4U

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	1	3	3	3	3	3
CO 2	3	3	2	3	2	3	3	3	3	3
CO 3	3	3	2	2	1	3	3	3	3	3
CO 4	3	3	2	2	1	3	3	3	3	3
CO 5	3	3	2	3	1	3	3	3	3	3
Average	3	3	2	2.2	1.2	3	3	3	3	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2304	Allied Zoology II	Supportive	3	3

This course focuses on the economic importance and applied aspects of zoology. The theory part deals with the principles and applications of cell biology and genetics, with reference to man. It also emphasizes details on areas like developmental biology, biochemistry, animal physiology, immunology and evolution.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the structure and functions of vital organ system.

CO2: Describe the different developmental stages and placentation in mammals.

CO3: Evaluate the immune systems and vaccination.

CO4: Discuss the concepts of human genetics and chromosomal inheritance.

CO5: Analyse the different behaviour of animals.

UNIT I **(9 Hours)**

Physiology: Respiration- respiratory pigments and transport of gases - mechanism of blood clotting - types of excretory products – ornithine cycle. Structure of neuron – conduction of nerve impulse mechanism of vision and hearing.

UNIT II **(9 Hours)**

Developmental biology: Fertilization – cleavage - gastrulation - organogenesis of frog - placentation in mammals.

UNIT III **(9 Hours)**

Immunology: Innate and Acquired - active and passive immunity - antigens – antibodies - lymphoid organs – responses in humans - vaccination schedule.

UNIT IV **(9 Hours)**

Human genetics: Human chromosomes – sex determination in human. Patterns of inheritance: autosomal dominant - autosomal recessive - X-linked - Y-linked - mitochondrial - multiple allelic – polygenic. Genetic counselling.

UNIT V **(9 Hours)**

Animal behaviour: Foraging - courtship behaviour - shelter and nest construction - parental care - learning behaviour.

Learning Resources

Text Books

1. Verma PS and Agarwal (1975). Chordata embryology S. Chand & Co.
2. Taylor DJ., Green NPO and Stout SW (2005). Biological Science. R. Soper Editor, 3rd Edition. Cambridge University Press, United Kingdom.

References

1. Klug WS., Cummings MR and Spencer C (2016). Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.
2. Mathur R (2010). Animal Behaviour. Meerut: Rastogi publications.
3. Nigam HC (1996). Modern Trends in Biology. Shohanlal Nagin Chand & Co, Jalandhar.

Websites/e-Learning resources

1. www.sanctuaryasia.com
2. www.iaszoology.com

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	1	1	1	3	3	2	2	3
CO 2	3	3	1	1	2	3	3	2	2	3
CO 3	3	3	2	2	1	3	3	2	2	3
CO 4	3	3	2	2	1	3	3	2	2	3
CO 5	3	3	2	2	1	3	3	2	2	3
Average	3	3	1.6	1.6	1.2	3	3	2	2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2102	Allied Zoology II - Lab	Supportive	2	1

This laboratory course provides hands on training with zoological techniques and principles covering developmental biology, physiology, genetics, immunology and animal behavior. It deepens their understanding of the subject.

Course Outcomes:

At the end of the course, students will be able to

CO 1: Identify the developmental stages of blastula and gastrula

CO 2: Analyse different excretory products of animals.

CO 3: Describe the lymphoid organs in chick.

CO 4: Estimate oxygen consumption in fishes.

CO 5: Distinguish different blood group in man and Mendelian traits.

Laboratory Exercises

1. **Slides**: i) Ovum ii) Sperm iii) Blastula iv) Gastrula.
2. **Spotters**: Types of placentas.
3. Qualitative test for ammonia, urea, and uric acid.
4. Vision Acuity test, Colour blindness-Ishihara chart
5. Oxygen consumption in fish
6. Lymphoid organ in chick.
7. Study of Mendelian traits in man.
8. Blood grouping in Man.
9. Observation of chemical communication in ants.

Learning Resources

References

1. Lal SS (2022). Practical Zoology-Vertebrate, Rastogi Publications, Meerut.
2. Sinha J., Chatterjee AK and Chattopadhyay (2019). Advanced Practical Zoology, Ruba Sen Books and Allied (P) Ltd, Kolkata.
3. Iyer E (1993) Manual of Zoology Vol. II. Viswanathan (Printers & Publishers), Chennai.
4. Jayaraman (1981). Laboratory Manual in Biochemistry, Wiley Eastern Pub., U.S.

5. Palanivel R., Dhanasekaran S and Pandian CJ (2017). LAP LAMBERT Academic Publishing.

Websites/ e-Learning Resources

1. https://uomustansiriyah.edu.iq/media/lectures/6/6_2019_12_01!05_06_08_PM.pdf
2. https://teachmint.storage.googleapis.com/public/658997664/StudyMaterial/1c8315a1-cd61-4285-ba46-98cab726e90b.pdf
3. http://nbtc.naco.gov.in/assets/resources/training/5.pdf
4. https://www.gputtawar.edu.in/downloads/blood%20group.pdf
5. https://egyankosh.ac.in/bitstream/123456789/16459/1/Unit-25.pdf

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	1	1	2	3	3	1	1	2
CO 2	3	3	3	3	2	3	3	2	1	2
CO 3	3	3	3	3	2	3	3	1	1	2
CO 4	3	3	3	3	2	3	3	1	1	2
CO 5	3	3	1	1	2	3	3	2	2	3
Average	3	3	2.2	2.2	2.6	3	3	1.4	0.8	2

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO2202	Medical Laboratory Techniques	SEC	3	2

The objective of this course is to enhance the skills of the students in the field of Medical Lab Technology thereby increasing the employability of the candidates. The course deals with laboratory safety and human health and hygiene. It also discusses the methods of biological specimen collection, preservation and analysis. The course further discusses about various tools, techniques and advanced equipment used in disease diagnosis.

Course Outcomes:

At the end of the course, students will be able to

CO1: Outline good laboratory practices of medical laboratory, health and lifestyle diseases and biomedical waste management.

CO2: Distinguish various components of blood, their functions and variations in health and disease conditions.

CO3: Demonstrate skill in performing medical microbiological tests and handling clinical equipment.

CO4: Evaluate the physiology of medically important systems such as heart and brain.

CO5: Discuss the histological techniques in diagnosing pathology.

UNIT I **(9 Hours)**

Laboratory Safety and Human Health and Hygiene: Laboratory safety –toxic chemicals and biohazards waste - biosafety level - good laboratory practice – hygiene and health issue – physiology effect of alcohol – tobacco - smoking - junk food - its treatment - biomedical waste management.

UNIT II **(9 Hours)**

Haematology: Composition of blood and their function- collection of blood & lab procedure – haemopoiesis - types of anaemia - mechanism of blood coagulation - bleeding time - clotting time - determination of haemoglobin - erythrocyte sedimentations rate - packed cell volume - Total count of RBC & 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 **(9 Hours)**

Medical Microbiology and Instrumentation Techniques: 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 **(9 Hours)**

Medical Physiology: Cardiovascular system - Blood pressure - Pulse – regulation of heart rate - cardiac shock. Heart sounds - Electrocardiogram (ECG) – significance – ultra sonography - Electroencephalography (EEG).

UNIT V **(9 Hours)**

Diagnostic Pathology: Handling and labelling of histology specimens – Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtomes - sectioning, staining – staining methods - vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.

Learning Resources

Text Books

1. Godker PB and Darshan P Godker (2011). Text book of medical Laboratory Technology, Mumbai.
2. Sood R (2009). Medical Laboratory technology, Methods and interpretation.
3. Mukerjee, K.L. (1999). Medical Laboratory Technology- Vol, I, II, III. Tata MC Graw Hill, New Delhi.

References

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

4. Guyton and Hall (2000). Text Book of medical Physiology, 10th Edition, Elseiner, New Delhi.

Websites/ e-Learning Resources

1. https://bit.ly/3tUs8In
2. https://bit.ly/2XKu7mT
3. https://bit.ly/3hNS1EP
4. https://bit.ly/2ZgrLga
5. https://bit.ly/3hTBO1b

CO - PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	2	2	1	3	3	2	1	3
CO 2	3	3	2	2	1	3	3	2	1	3
CO 3	3	3	2	2	1	3	3	2	1	3
CO 4	3	3	2	3	1	3	3	2	1	3
CO 5	3	3	2	3	1	3	3	2	1	3
Average	3	3	2	2.4	1	3	3	2	1	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3601	Immunology (TcL)	Core	6 (4+2)	6

The course covers cells and organs of the immune system, antigens, antibody structure, antibody diversity, antigen-antibody interactions, cell mediated and humoral immune response and complement. Disorders of immune system, autoimmunity, hypersensitivity reactions, immunodeficiency disorder and graft rejection are dealt. The laboratory component includes location of lymphoid organs, preparation of antigens, immunization techniques, repetitive bleeding methods, antibody titration and skin test for allergy reactions.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Describe the importance of Immune cells and lymphoid organs.

CO2: Discussion the nature of antigens, antibody and their interactions.

CO3: Demonstrate the immune response mediated by MHC and lymphocytes.

CO4: Evaluate immune regulation and immune tolerance.

CO5: Analyse the hypersensitivity and deficiency in immune system.

UNIT I **(12 Hours)**

Overview of the immune system: Introduction - historical perspectives - innate (non-specific) and acquired (specific) immunity – humoral and cell mediated immunity - cells of immune system - primary & secondary lymphoid organs - vaccines.

UNIT II **(12 Hours)**

Antigens, antibody and their interactions: Antigen - Types- factors influencing immunogenicity - adjuvants - Structure and Biological properties of Immunoglobulin classes – IgG, IgM, IgA, IgD and IgE. Primary interactions - affinity and avidity - secondary interaction - agglutination - precipitation.

UNIT III **(12 Hours)**

Immune Response: Humoral and cell mediated immunity - Primary and Secondary response - MHC – Structure- Antigen Processing and Presentation - Biology and Activation of B and T Lymphocytes.

UNIT IV **(12 Hours)**

Regulation of Immune Response and Tolerance : Cytokines - Complement

components - Biological properties - Classical and alternate pathways- Immunotolerance - Autoimmunity - SLE and Rheumatoid arthritis.

UNIT V **(12 Hours)**

Hypersensitivity, Immunodeficiency disorders and Transplantation: Overview of Type I, II, III, IV Hypersensitivity reactions - Immunodeficiency disorders - AIDS - Graft rejection - types of Grafts and mechanism of graft rejection.

Laboratory Exercises

1. Total and differential count of white blood cells
2. Lymphoid organs in vertebrates I - fish
3. Lymphoid organs in vertebrates II- Chick
4. Preparation of Soluble and Insoluble Antigens
5. Routes of immunization
6. Bleeding techniques
7. Separation of serum and plasma.
8. Isolation of Lymphocyte using Ficoll Solution
9. Ouchterlony double immunodiffusion (ODI)
10. Mancini's single radial immunodiffusion (SRID)
11. Immunology of ABO blood grouping.
12. Agglutination assay
13. Lab visit

Learning Resources

Text Books

1. Kindt TJ., Osborne BA and Goldsby RA (2006). Kuby Immunology. 6th Edition. W.H. Freeman and Co., New York.
2. Coico R and Sunshine G (2009). Immunology – a short course. 6th Edition, Wiley Blackwell, New York.

References

1. Garvey JS., Cremer NE and Sussadorf DH (1977). Methods in Immunology. 3rd Edition, The Benjamin Cummings Pub co., Massachusetts.
2. Hudson L and Hay F (1989). Practical Immunology. 3rd Edition, Blackwell Science Publishers, Oxford.

3. Roitt IM., Brostoff J and Male D (2001). Immunology. 6th Edition, Mosby, London.

Websites/ e-Learning Resources

1. https://www.ibiology.org/educators-resources/flipped-courses/immunology-flipped-course/
2. https://www.niaid.nih.gov/research/immune-system-overview
3. https://www.inside-immunity.org/en.php
4. https://libguides.apsu.edu/c.php?g=933975&p=6732209
5. https://www.youtube.com/watch?v=_VhcZTGv0CU
6. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/LN_Imm_Serology_final.pdf
7. https://alleninstitute.org/resource/introduction-to-immunology/

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	2	3	3	3	2	2	2
CO 2	3	3	3	3	3	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	2	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	3	2	3	3	3	3	2	2	3
Average	3	3	2.8	2.6	3	3	3	2	2	2.2

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3603	Entomology (TcL)	Core	6 (4+2)	6

This course deals the basics of insect classification, morphology, anatomy, physiology and other facts of insect's life and about their economic importance. It covers the classification upto order level and the role of insect as pests, vectors and beneficial insects. The laboratory course intended to systematically collect, preserve and identify insects.

Course Outcomes:

At the end of the course, students will be able to

CO1: Outline the classification of insects up to order level.

CO2: Compare the anatomy of insects of different groups.

CO3: Discuss the physiology of insects and metamorphosis.

CO4: Identify pests of various crops and assess the damage and control.

CO5: Assess the insects of economic, medical and forensic importance.

UNIT I **(12 Hours)**

Insect taxonomy: Scope of entomology - biological success of insects - insect diversity - insect evolution. Insect collection – preservation - dichotomous key – classifications up to orders.

UNIT II **(12 Hours)**

Insect anatomy: Integument of insects - Head - Types of mouth parts – antennae - legs - wings.

UNIT III **(12 Hours)**

Insect physiology: Feeding and digestion - Respiration - Circulation - Nervous system - Endocrine system – Reproductive system - Metamorphosis.

UNIT IV **(12 Hours)**

Harmful insects: Pests of paddy: *Orseolia oryzae*. Coconut pest: *Oryctes rhinoceros.* Sugarcane pest: *Pyrilla perpusilla*. Cotton pest: *Aphis gossypii*. Brinjal pest: *Leucinodes orbonalis.* damage - symptoms - control.

UNIT V **(12 Hours)**

Beneficial insects: Biology - rearing - economic importance of silk worm - honey bees - lac insects - Insects of medical and forensic importance.

Laboratory Exercises

1. Collection and identification of insects.
2. Study of beneficial insects.
3. Investigation of a few agricultural pests.
4. Investigation of insects of public health importance.
5. Identification of storage pests.
6. Survey on the insects available in the campus.
7. Identification and comments on a few pterygotan insects.
8. Evaluation of pesticide toxicity (LC_{50}).
9. Identification of economic values of productive insects.
10. Estimation of biodiversity of insects in an ecosystem.
11. Field study.

Learning Resources

Text Book

1. David BV and Ananthakrishnan TN (2004). General and Applied Entomology. Tata McGraw-Hill Publishing Company Limited, New Delhi.

References

1. Ambrose DP (2004). The Insect Structure, Function and Biodiversity. Kalyani publishers, New Delhi.
2. Fennemore PG and Alka Prakhash (1992). Applied Entomology, Wiley Eastern Ltd., New Delhi.
3. Richards OW and Davies RG (1977). Imm's General Text book of Entomology Vol. I & II. 10^{th} Edition. B_1 Publication Pvt Ltd., New Delhi.

Websites/ e-Learning Resources

1. https://earthlife.net/insect-classification-taxonomy/
2. https://earthlife.net/what-is-an-insect/anatomy/
3. https://en.wikipedia.org/wiki/Insect_physiology
4. https://www.discoverwildlife.com/animal-facts/insects-invertebrates/deadliest-insects
5. https://extension.okstate.edu/fact-sheets/beneficial-insects.html

CO - PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	2	3	3	3	2	2	2
CO 2	2	2	3	2	2	3	3	2	2	3
CO 3	3	3	2	2	3	3	3	2	2	3
CO 4	3	2	3	2	2	3	3	2	2	2
CO 5	3	3	2	2	3	3	3	3	3	3
Average	2.8	2.6	2.6	2	2.6	3	3	2.2	2.2	2.6

High Correlation-3, Medium Correlation-2, Low Correlation-2, No Correlation'- '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3605	**Developmental Biology (TcL)**	**Core**	**6 (4+2)**	**6**

This course is designed to characterize classical views and knowledge on the various aspects of development of animals with experimental approach. The course deals with gametogenesis, fertilization, cleavage patterns, embryonic stem cells, cleavage & gastrulation, and organogenesis in a mammal. Experimental embryological aspects such as embryonic induction, differentiation and nucleocytoplasmic interaction are discussed in detail.

Course Outcomes:

At the end of the course, students will be able to

CO1: Discuss the structures and functions of gonads, gametes, processes in fertilization and parthenogenesis.

CO2: Outline the processes of cleavage, gastrulation and organogenesis.

CO3: Analyse types, structure & functions of placenta, mechanism of regeneration and metamorphosis.

CO4: Explain embryonic induction, organizers, differentiation and interactions of nucleus and cytoplasm.

CO5: Apply the knowledge of embryonic stem cells and embryo transplantation.

UNIT I **(12 Hours)**

Gametogenesis and Fertilization: Basic concepts of developmental biology. Structure and types of Spermatozoa - Egg - Egg membranes-types of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism - theories - significance – Parthenogenesis.

UNIT II **(12 Hours)**

Blastulation and Gastrulation: Cleavage - Planes and Pattern- Factors controlling cleavage - Fate map and its construction. Blastulation – types of blastula. Morphogenetic movements - Gastrulation of frog & chick.

UNIT III **(12 Hours)**

Organogenesis: Development of Brain - Eye - Heart in frog. Development of Nervous system in chick - Foetal membranes in chick - Development of Pro, Meso, Metanephric kidneys. Placentation in Mammals.

UNIT IV **(12 Hours)**

Applied embryology: Organizer concept –Structure – mechanism of induction and competence. Types and process of differentiation - nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Embryonic stem cells & significance -Methods to culture embryo.

UNIT V **(12 Hours)**

Human embryology: Reproductive organs, Menstrual cycle and menopause - Pregnancy – trimesters – development. Erythroblastosis foetalis - Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.

Laboratory Exercises

1. Observing the effect of thyroxine in frog metamorphosis.
2. Chick's developmental stages at 24,48,72 and 96 hours using slides.
3. Dissection and mounting of chick embryo blastoderm.
4. Observation of slides and specimen
    a) Mammalian testis and Ovary-Structure
    b) Mammalian egg and sperm
    c) Developmental stages of frog cleavage, blastula, gastrula and neurula
    d) Study of egg types.
5. Examination of direct and indirect larval developmental stages in invertebrates
6. Analysing regenerative capacity in tadpole tail and lizard limb
7. Observation of placenta formation in sheep and pig
8. Isolation of Zebra fish embryo
9. Visiting nearby IVF centre

Learning Resources

Text Books

1. Balinsky BI (2012). An introduction to Embryology. 5th Edition Thomson Asia Pvt. Ltd., Singapore
2. Lewis Wolpert (2007). Principles of development, 3rd Edition, Oxford University Press, New Delhi, India
3. Subramoniam T (2003). Developmental Biology, Narosa Publishing House, New Delhi, India.

4. Verma PS and Agarwal VK (2010). Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi., India.

References

1. Laura RK., Evans JH and Keller TCS (1999). Experimental Developmental Laboratory: A Laboratory Manual. Academic Press, UK.
2. Jain PC (1994). Elements of Developmental Biology. Vishal Publications, Jalandhar, New Delhi.
3. Verma PS and Agarwal VK (2006). Chordate Embryology. S. Chand & Company Ltd., New Delhi
4. Russ Hodge (2010). Developmental Biology, Facts on File, Inc., New Delhi.
5. Carlson and Bruce M (2009). Human embryology and Developmental Biology, Elsevier, Philadelphia, USA.

Websites/ e-Learning Resources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8406655/
2. https://organismalbio.biosci.gatech.edu/growth-and-reproduction/animal-development-ii/
3. https://link.springer.com/chapter/10.1007/978-1-4615-6915-2_21
4. https://www.ncbi.nlm.nih.gov/books/NBK10002/
5. https://study.com/academy/lesson/experimental-embryology-definition-principles.html

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	1	1	3	1	1	2	2
CO 2	3	3	3	1	1	3	1	1	2	2
CO 3	3	3	3	1	1	3	1	1	1	2
CO 4	3	3	3	2	1	3	1	1	1	2
CO 5	3	3	3	1	1	3	3	3	3	3
Average	3	3	3	1.2	1	3	1.4	1.4	1.8	2.2

High Correlation-3: Medium correlation – 2: Low Correlation – 1 No Correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3401	**Molecular Biology (TcL)**	**DSE**	**5 (3+2)**	**4**

Molecular biology deals with the study of structure and function of genes and genomes. It gives the finest details of molecular configurations of genes, their physical properties and their nature of replication, recombination, mutation and transposition. This course also introduces how genes express and accurately transmit genetic information, and the mechanism of its regulation. The laboratory course introduces the basic molecular biological methods of isolation, purification and quantification of nucleic acids from cells and also experiments on mutagenesis.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Explain the molecular nature of nucleic acids.

CO2: Describe the mechanisms involved in DNA replication, recombination and mutation.

CO3: Compare the transcription process in prokaryotes and eukaryotes.

CO4: Discuss the mechanisms involved in transcription.

CO5: Analyse the transposable elements and the regulation of gene expression using operon models.

UNIT I **(9 Hours)**

The molecular nature of DNA and RNA: Introduction to gene structure and function – DNA double helix –Alternate forms of DNA – Physical properties – G:C content, c-value and cot curves – Extra nuclear genomes – Structure and types of RNA – DNA sequencing method -human genome project.

UNIT II **(9 Hours)**

DNA replication, recombination and mutation: Semiconservative replication – bidirectional – unidirectional – rolling circle and theta model replication – enzymology of DNA replication – Homologous and site-specific recombination - gene mutation – types – causes for DNA damage.

UNIT III **(9 Hours)**

Transcription: RNA polymerases – Mechanisms of transcription in prokaryotes and

eukaryotes – General transcriptional factors of eukaryotes – post-transcriptional processing – capping – polyadenylation - splicing - alternate splicing.

UNIT IV **(9 Hours)**

Translation: Genetic code – deciphering - salient features – 3D structure of tRNA – codon – anticodon interaction – wobble hypothesis – mechanism of protein synthesis in prokaryotes and eukaryotes – inhibitors of protein synthesis – post translational modification.

UNIT V **(9 Hours)**

Transposition and regulation of gene expression: IS elements – transposable elements in maize and drosophila- Fine control of prokaryotic transcription – Lac operon – Gene regulation in eukaryotes: GAL system in yeast.

Laboratory Exercises

1. Introduction to molecular biology lab –handling devices, tools and buffer preparation.
2. Isolation and purification of genomic DNA from *E. coli*.
3. Extraction of DNA from blood.
4. Isolation of RNA from liver cells.
5. Agarose gel electrophoresis for DNA and RNA.
6. Estimation of DNA by diphenylamine method.
8. Quantification of RNA by Orcinol method.
9. UV induced mutagenesis in *E. coli*.
10. Chemical mutagenesis.
11. Visit to university/institutional laboratories/industries.

Learning Resources

Text Books

1. Lodish H., Berk A., Kaiser CA., Krieget M., Bretscher A., Ploegh H., Amon A and Martin KC (2016). Molecular Cell Biology, 8th Edition. New York:
2. Malacinski GM (2003). Freidfelder's Essentials of Molecular Biology. 4th Edition, Narosa Publishing House, New Delhi, India.

References

1. De Robertis EDP and Robertis EMF (2017). Cell and Molecular Biology 8th Edition, LWW.

2. Rastogi VR (2019). Text Book of Genetics and Medical technology.
3. Brown TA (2023). Genomes 5. 5th Edition, CRC Press.
4. Watson JD., Kopkins NK., Roberts JW., Stertz JA and Weiner AM (1994). Molecular Biology of the Gene. Benjamin and Cummings Pub Co., California.
5. Rajamanickam C (2001). Experimental Protocols in Basic Molecular Biology. Osho Scientific Publishers, Madurai.
6. Bansal MP (2013). Molecular Biology and Biotechnology Protocols. TERI, Delhi.
7. Carson S., Miller HB and Witherow DS (2012). Molecular Biology Techniques: A classroom Laboratory Manual. Third Edition. Academic Press, San Diego, USA.

Websites /e-Learning Resources

1. https://www.ndsu.edu/pubweb/~mcclean/plsc431/transelem/trans1.htm
2. https://www.ndsu.edu/pubweb/~mcclean/plsc431/prokaryo/index.htm
3. https://www.vedantu.com/biology/mutagens

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	3	2	3	3	1	3	3
CO 2	3	3	1	3	3	3	3	2	3	3
CO 3	3	3	2	3	2	3	3	2	2	3
CO 4	3	3	1	3	2	3	3	2	2	3
CO 5	3	3	2	3	2	3	3	2	2	3
Average	3	3	1.6	3	2.2	3	3	1.8	2.4	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3403	Bioinstrumentation (TcL)	DSE	5 (3+2)	4

This course includes the good laboratory practices and the working principle of different instruments and their biological applications. It gives special emphasis on spectrophotometry, centrifugation, biosensors, chromatography and advance molecular techniques such as PCR and hybridization techniques.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Explain the good laboratory practices and handling of laboratory animals.

CO2: Describe the different types of biosensors and techniques in photometry.

CO3: Discuss the techniques used to separate biomolecules.

CO4: Analyse the blood parameters and imaging processes using instruments.

CO5: Demonstrate the various molecular techniques in lab.

UNIT I **(9 Hours)**

Good Laboratory Practices: Guidelines - laboratory symbols - cleaning and sterilization of lab ware and reagents- handling and care of laboratory animals- laminar flow hood- types and use- buffers- preparation of buffers- pH meter- safety and ethical issues in laboratory settings.

UNIT II **(9 hours)**

Biosensors and spectrophotometry: Glucose biosensor- alcohol biosensor- environmental biosensors - cantilever based biosensors - DNA biosensor – spectrophotometry - mass spectrophotometry - Spectro fluorometry - FTIR.

UNIT III **(9 hours)**

Centrifugation and Chromatography: Working principle and types of centrifugations - chromatography - principle and types of chromatography - HPLC - GC.

UNIT IV **(9 hours)**

Biomedical Instrumentation: ESR measurement- haemoglobin measurement- overview on blood pressure - blood flow- ECG- pacemakers - X- ray imaging- CT scan and NMR imaging - ultrasound imaging - medical applications of laser.

UNIT V **(9 hours)**

Molecular Techniques: Isolation of DNA, RNA and proteins- Electrophoresis of DNA and proteins- Polymerase chain reaction- ELISA- Immunofluorescence- Fluorescent *in situ* hybridization- Southern- Western and Northern blotting.

Laboratory Exercises

1. Colorimetry
2. UV-Vis Spectrophotometry
3. Atomic absorption spectrophotometer
4. Centrifugation
5. pH meter
6. Microtome
7. Chromatography -HPLC
8. Flame photometry
9. Electrophoresis: Polyacrylamide gel electrophoresis
10. ECG
11. EEG
12. Visit to diagnostic labs.

Learning Resources

Text Books

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

References

1. Sue Carson., Heather Miller., Melissa Srougi and Scott Witherow (2019). Molecular Biology Techniques: A Classroom Laboratory Manual, Academic Press, New York, USA.
2. Aysha Divan and Janice Royds (2013). Tools and Techniques in Biomolecular Science, Oxford University Press, UK.

3. Gordon MH and Macrae R (2012). Instrumental Analysis in the Biological Sciences, Blackie & Son Ltd., UK
4. Leonard Davis., Mark Dibner and James Battey (2012). Basic Methods in Molecular Biology, Elsevier Science Publishing Co., New York, USA.
5. Wilson KM and Walker JM (2010). Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, UK.

Websites/ e-Learning Resources

1. https://bit.ly/3i5flym
2. https://pbiol.rsb.org.uk
3. https://www.nature.com/subjects/biological-techniques
4. https://www.ibiology.org

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	3	3	3	2	2	2
CO 2	3	3	1	1	2	3	3	2	2	2
CO 3	3	3	3	3	2	3	3	2	2	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	3	3	3	2	3	3	2	2	2
Average	3	3	2.4	2.4	2.4	3	3	2	2	2

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3301	Human Reproduction and Conception Control	GE	4	3

This course includes female and male sexual anatomy and physiology, patterns of sexual behaviour, conception, pregnancy, child birth, contraceptive methods, sexually transmitted diseases, reproductive disorders and therapy.

Course Outcomes:

At the end of the course, students will be able to

CO1: Outline the anatomy of female reproductive organs and its function.

CO2: Discuss the anatomy of male reproductive organs and its function.

CO3: Analyze the types of love, sexual behaviour patterns, conception, pregnancy, foetal development and parturition.

CO4: Evaluate the methods of contraception and birth control.

CO5: Assess the causes of sexually transmitted diseases, common sexual disorders and their prevention.

UNIT I **(12 Hours)**

Anatomy and physiology of female reproductive system: External genitalia and internal structures - breasts - menstruation - ovulation - hormonal control.

UNIT II **(12 Hours)**

Anatomy and physiology of male reproductive system: External genitalia and interna structures - male sexual function - erection - ejaculation - circumcision.

UNIT III **(12 Hours)**

Sexual behaviour pattern, conception and pregnancy: Love - types - celibacy - erotic dreams - fantasy - masturbation - homosexuality - atypical sexual behaviour - Sexual arousal - role of hormones - brain - senses - food - chemicals - Sexual response - three stage and four phase model - Conceiving - pregnancy - foetal development - stages of child birth - breast feeding.

UNIT IV **(12 Hours)**

Contraceptive methods and fertility control: Contraceptive methods - hormone based oral and non-oral contraceptives - barrier methods - intrauterine devices - methods based on menstrual cycle - post-coital contraceptive methods - abortion -

choice of contraception at different ages - Fertility control - male and female sterilization.

UNIT V **(12 Hours)**

Sexual diseases and disorders of reproductive system: Common vaginal infections - Sexually transmitted diseases - gonorrhoea - syphilis - AIDS - prevention - Disorders - hypoactive sexual desire - erectile - dyspareunia - orgasmic disorders - chronic illness and disabilities - menstrual cycle problems - Basics of sexual enhancement and sex therapy.

Learning Resources

Text Book

1. Crooks R and Baur K (1996). Our sexuality. 6th Edition, Brook /Cole publishing Company, California, USA.

References

1. Chaudhuri SK (1999). Practice of fertility control - A comprehensive text book. 4th Edition, B.I. Churchill Livingstone Pvt. Ltd., New Delhi.
2. Shapiro HI (1988). The Birth Control Book. Prentice Hall Press, New York.
3. Vander AJ., Sherman JH and Luciano DS (2001). Human Physiology: The Mechanism of Body Function. VIII Edition, McGraw Hill Inc. New Delhi.

Websites/ e-Learning Resources

1. https://opentextbc.ca/biology/chapter/13-3-human-reproduction/
2. https://library.med.utah.edu/kw/human_reprod/Syllabus.pdf
3. https://ncert.nic.in/textbook/pdf/lebo103.pdf
4. https://nios.ac.in/media/documents/SrSec314NewE/Lesson-21.pdf

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	1	1	1	2	2	2	1	1
CO 2	3	3	1	2	1	2	2	1	1	1
CO 3	3	3	1	1	1	2	2	1	1	1
CO 4	3	3	1	2	1	2	1	1	1	2
CO 5	3	3	2	2	1	2	1	2	1	3
Average	3	3	1.2	1.6	1	2	1.6	1.4	1	1.6

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3303	**Food, Nutrition and Health**	**GE**	**4**	**3**

This course covers the basic concepts of balanced diet for people of different ages besides focusing on the consequences of malnutrition, deficiency diseases and diseases caused due to poor hygiene.

Corse Outcomes:

At the end of the course, the students will be able to

CO1: Classify nutrients and the dietary pattern for different groups.

CO2: Categorize macro -micro nutrients and their importance.

CO3: Identify the malnutrient deficiency diseases, their causes and preventive measures.

CO4: Summarize the life style dependent diseases.

CO 5: Describe the diseases caused by microorganisms.

UNIT I **(12 Hours)**

Nutrition and dietary nutrients: Basic concepts of Food: Components and nutrients. Concept of balanced diet - nutrient requirements and dietary pattern for different groups viz., pregnant and nursing mothers – infants - school children – adolescents - adults - elderly people.

UNIT II **(12 Hours)**

Macronutrients and micronutrients: Macronutrients. Carbohydrates – Lipids - Proteins- Definition, their dietary source and role. Micronutrients. Vitamins- Water-soluble and Fat-soluble vitamins- their sources and importance. Important minerals - Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions.

UNIT III **(12 Hours)**

Malnutrition and nutrient deficiency diseases: Definition and concept of health: Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders- their symptoms, treatment, prevention and government initiatives.

UNIT IV **(12 Hours)**

Life style dependent diseases: Hypertension, diabetes mellitus, and obesity their causes and prevention. Social health problems- smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes - treatment - prevention.

UNIT V **(12 Hours)**

Microbial Disease-Food hygiene: Potable water- sources and methods of purification at domestic level. Food and Water-borne infections: Bacterial diseases: typhoid fever - viral diseases: Poliomyelitis - Protozoan diseases: Giardiasis - Parasitic diseases: Taeniasis and their transmission, causative agent, sources of infection, symptoms and prevention.

Learning Resources

Text Books

1. Swaminathan M (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
2. Srilakshmi B (2007). Food Science; Fourth Ed; New Age International (P) Ltd.

References

1. Mudambi SR and Rajagopal MV (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; New Age International Publishers.
2. Bamji MS., Rao NP and Reddy V (2009). Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd.
3. Lakra P and Singh MD (2008). Textbook of Nutrition and Health; 1st Edition Academic Excellence.
4. Gibney MJ *et al*., (2004). Public Health Nutrition; Blackwell Publishing.

Websites/ e-Learning Resources

1. https://med.libretexts.org/Courses/Dominican_University/DU_Bio_1550%3A_Nutrition_(LoPresto)/1%3A_Basic_Concepts_in_Nutrition/1.1%3A_Introduction_to_Nutrition
2. https://pressbooks.bccampus.ca/nutr1100/chapter/introduction-2/
3. https://www.pw.live/chapter-food-where-does-it-come-from/classification-of-food
4. https://www.bethaniyaclinic.com/blog/diet-nutrition-and-disease-management/
5. https://nutritionalassessment.org/

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	3	3	3	1	2	3	3	3	3
CO 2	3	3	3	3	2	2	3	3	3	3
CO 3	3	3	3	3	1	2	3	3	3	3
CO 4	3	3	3	3	1	2	3	3	3	3
CO 5	3	3	3	3	1	2	3	3	3	3
Average	3	3	3	3	1.2	2	3	3	3	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3255	Internship	IS	-	2

Internship is intended to impart research experience, practice work experience, create professional network, offer career guidance, help to write resume. Internship will be carried out at research institutions, diagnostic laboratories, agricultural, poultry, fisheries, dairy and other relevant industries. The training experience will be compiled into a report.

Course Outcomes:

At the end of the course, students will be able to

CO1: Demonstrate employable/entrepreneurial skills.

CO2: Describe specific research objectives.

CO3: Choose appropriate career of interest.

CO4: Revise goal for continuous development.

CO5: Devise strategies for life-long growth.

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	3	2	3	3	3	2	3
CO 2	3	3	3	3	3	3	3	2	2	3
CO 3	3	3	3	3	2	3	3	2	2	3
CO 4	3	3	3	3	2	3	3	3	2	3
CO 5	3	3	3	3	2	3	3	3	2	3
Average	3	3	3	3	2.2	3	3	2.6	2	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3201	Ornithology	SEC	3	2

This course provides key insights on taxonomic position and role played by birds in the ecosystem, their importance to humans and their evolution. It also comprehends the biological evolution of birds and their structural adaptations. Behaviour and breeding biology of birds is also emphasized. It also deals with macroecology of birds, bird populations and communities, bird diseases, bird conservation and role of human science in ornithology.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the taxonomic position and speciation.

CO2: Identify the adaptive features in birds.

CO3: Describe the different aspects of behaviour and migration in birds.

CO4: Examine the breeding biology of birds.

CO5: Discuss the threats and conservation of birds.

UNIT I **(9 Hours)**

Introduction to ornithology: Bird Lore - birds and humans - classification of birds - bird evolution – speciation – endemism.

UNIT II **(9 Hours)**

External morphology of the bird: Structure of bird feather - internal structure of the bird - flight adaptation in birds- Archaeopteryx and its evolutionary significance - beaks and feet in birds.

UNIT III **(9 Hours)**

Bird Behaviour: Foraging – roosting – vocalization – imprinting - feather care - bird intelligence - social behaviour - mixed species flocks – migration.

UNIT IV **(9 Hours)**

Breeding Biology: Differential investment of sexes – territoriality - courtship and display behaviour – nesting- eggs - incubation and care of young - brood parasitism.

UNIT V **(9 Hours)**

Studying bird populations, communities and sampling methods: Macro ecology - molecular techniques in ornithology - avian disease - citizen science and ornithology - bird watching - threats faced by birds - bird conservation with case studies.

Learning Resources

Text Books

1. Ali S (2002). The Book of Indian Birds. Bombay Natural History Society, Mumbai, India.
2. Jordan EL and Verma PS (2013). Chordate Zoology, S. Chand & Co Ltd., New Delhi.

References

1. Lovette IJ and Fitzpatrick JW (2016). Handbook of Bird Biology, 3rd Edition Wiley.
2. Birkhead T (2013). Bird Sense: What it's like to be a bird? Bloomsbury, NY.
3. Birkhead T., Wimpenny J and Montgomerie B (2014). Ten Thousand Birds: Ornithology since Darwin. Princeton University Press, Princeton, NJ.
4. Gill FB and Prum RO (2019). Ornithology, 4th Edition. Macmillan.
5. Ali S and Ripley SD (2002). Handbook of the Birds of India and Pakistan. Vol 1-10, 2nd Edition, Oxford University Press, India.
6. Grimmett R, Inskipp C and Inskipp T (2012). Pocket Guide to the Birds of the Indian Subcontinent (Helm Field Guides). 2nd Edition. Christopher Helm Publishing Company Ltd., UK.

Websites/ e-Learning Resources

1. https://www.allaboutbirds.org/guide/
2. https://www.stateofindiasbirds.in/wp-content/uploads/2020/02/SOIB_Web-version_Final_.pdf
3. https://ebird.org/india/home

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	1	2	2	1	1	2	1	2	1
CO 2	3	1	2	2	1	1	1	1	2	1
CO 3	3	3	2	2	2	1	1	3	2	2
CO 4	3	2	2	2	2	3	3	3	2	3
CO 5	3	3	3	3	2	3	3	3	2	3
Average	3	2	2.2	2.2	1.6	1.8	2	2.2	2	2

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24 ZOO3802	**Biotechnology (TcL)**	**Core**	**8 (5+3)**	**8**

This course deals with various theoretical aspects of biotechnology including r-DNA techniques, animal, plant, microbial, industrial and environmental biotechnology. The course also imparts gene cloning strategies and intellectual property rights. The laboratory course integrates theory with extensive practical training on recombinant DNA techniques, cell culture methods.

Course Outcomes:

At the end of the course, students will be able to

CO1: Evaluate the fundamental recombinant DNA techniques and gene cloning strategies.

CO2: Analyse the methods used for the therapeutic applications of recombinant DNA techniques.

CO3: Explain the hybridoma technology, the basics of transgenesis, animal and plant tissue culture.

CO4: Assess the methods used in environmental and industrial biotechnology.

CO5: Describe the basic concepts and need for Intellectual Property Rights.

UNIT I **(15 Hours)**

Recombinant DNA Technology tools for gene cloning: DNA manipulative enzymes: Restriction enzymes and DNA ligases. Gene cloning vector types: – pBR322 Plasmids - Bacteriophage - Lambda and Cosmides – Ti plasmids -Major steps involved in cloning of human insulin gene - Gene transfer techniques – Microinjection - Electroporation – Basic gene cloning strategies.

UNIT II **(15 Hours)**

Application of r-DNA techniques in human health: Recombinant DNA proteins and their uses: Interferon- Interleukin - Tissue plasminogen activator. Recombinant vaccines: Hepatitis-B and Rabies. Commercial production of Penicillin – DNA amplification by PCR – PCR based molecular markers - RFLP - RAPD - DNA fingerprinting and application in forensic science.

UNIT III **(15 Hours)**

Cell culture techniques and transgenesis: Production and applications of

monoclonal antibodies- Basic requirements and techniques of animal cell culture-natural and artificial culture media, primary culture –mechanical and enzymatic methods- cell lines- Cloning of animals: Methods and uses-Transgenic Animals: Transgenic fish and sheep. Transgenic plant -golden rice- Plant tissue culture-applications.

UNIT IV **(15 Hours)**

Environmental and Industrial Biotechnology: Super Bug to control oil pollution - Advantages of Single Cell Proteins (SCP) - Fermentation process - Biogas production and advantages - Characteristics of the microbes used in industrial biotechnology- Biomining process - Enzyme immobilization-methods and advantages.

UNIT V **(15 Hours)**

Intellectual property rights: Basic concepts and need for IPR– Patent Act 1970 and its amendments- IPR in India and in other countries – Patent- procedure for obtaining patents – onco-mouse – Superbug- other forms of IPR - Trade Marks - Geographical Indications - importance- copyright law- authorship and Trade Secrets- benefits – TRIPS- Covid vaccine.

Laboratory Exercises

1. Purification of plasmids from *E. coli.*
2. Restriction digestion of DNA.
3. Ligation of DNA.
4. DNA amplification by PCR.
5. Agarose gel electrophoresis of DNA samples.
6. Introduction to basic cell culture processes and procedures–Passaging, trypsinization and cryopreservation of cell lines (Demonstration).
7. Preparation of culture media for animal cell culture.
8. Primary cell culture using chick embryo.
9. Isolation of splenocytes from goat spleen and Culture of splenocytes.
10. Preparation of MS medium for plant tissue culture.
11. Surface sterilization of explants and Initiation of callus on MS medium.
12. Demonstration of biogas production unit.
13. Field/ Industrial visits.

Learning Resources

Text Books

1. Sathyanarayran U (2005). Biotechnology, Books and Allied Pvt. Ltd, Kolkata, India.
2. Ignacimuthu S (2012). Biotechnology-An introduction, Narosa publishing house, New Delhi.

References

1. Rastogi VB (2016). Principles of Molecular biology, Med. Tech, Maine, USA.
2. Michael Crichton (2014). Essentials of Biotechnology, Med. Tech, Maine, USA.
3. Godbey WT (2014). An Introduction to Biotechnology, Academic press, New York, USA.
4. Rastogi SC (2007). Biotechnology: Principles and applications, Alpha Science publishers.
5. Ranga MM (2003). Animal biotechnology, Agrobios, New Delhi.
6. Primrose SB (2001). Molecular Biotechnology. 2nd Edition, Panima Publishing Corporation, New Delhi.
7. Gupta PK (1996). Elements of Biotechnology. Rastogi and Co., Meerut.

Website/ e-Learning Resources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/
2. https://www.isaaa.org/resources/publications/pocketk/40/default.asp
3. https://www.ncbi.nlm.nih.gov/books/NBK207574/
4. https://iopscience.iop.org/article/10.1088/1755-1315/492/1/012035/pdf
5. https://go.nature.com/3zAZmO9
6. https://blog.ipleaders.in/biotechnology-patenting-in-india-and-a-comparison-with-the-us-perspective/
7. https://tcgibp.com/all-you-need-to-know-about-biotechnology-patents-in-india/
8. https://www.labiotech.eu/trends-news/did-you-know-the-biotech-processes-behind-wine-and champagne/

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	3	3	2	2	2	2	1
CO 2	3	3	3	3	3	2	3	2	2	3
CO 3	3	3	3	3	3	2	3	2	2	3
CO 4	3	3	3	3	3	2	3	2	2	3
CO 5	3	3	2	3	3	2	3	2	2	3
Average	3	3	2.6	3	3	2	2.8	2	2	2.6

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation – '–'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24 ZOO3602	Biodiversity (TcL)	Core	6 (4+2)	6

The course aims to provide students a broad foundation in biodiversity and conservation biology with the ability to acquire extensive subject knowledge in the discipline. It will enable the students to understand biodiversity in the context of ecosystem dynamics, ecosystem functioning and provision of ecosystem services.

Course Outcomes:

At the end of the course, students will be able to

CO1: Revise the concepts of biodiversity and its measurement.

CO2: Explain the values and significance of biodiversity.

CO3: Discuss threats to biodiversity and wild life conservation.

CO4: Apply relevant scientific principles in the area of conservation biology.

CO5: Analyse the role of NGOs and various environmental movements in biodiversity conservation.

UNIT I **(12 Hours)**

Basics of Biodiversity: Concept, definition, scope and constraints of biodiversity - Types of biodiversity. Measuring biodiversity - Alpha, Beta and Gamma Diversity - Species richness – Evenness - Dominance - Shannon and Simpson's index. India as a mega-diversity nation - Hotspots of Biodiversity.

UNIT II **(12 Hours)**

Value and significance of biodiversity: Consumptive use value - Productive use value - Social value - Ethical and moral values - Aesthetic value - Optional value. Significance - Anthropocentrism, Biocentrism, Ecocentrism and Religion - Human-animal conflicts. Existing conservation projects – Tiger – Rhino – Elephant – Turtles – Crocodiles – Birds - Coral reefs - Mangroves.

UNIT III **(12 Hours)**

Threats to biodiversity: Loss of Biodiversity and its causes - Patterns of losses - Causes and factors of mass extinction - Listing of Threatened biodiversity including vulnerable – rare – threatened - Endangered - animal species - Wildlife Trade and Laws - Wildlife Protection Act of India - CITES - TRAFFIC - RED Data Book - IUCN.

UNIT IV **(12 Hours)**

Conservation of biodiversity: Conservation of Genetic, Species and Ecosystem and biodiversity - International conventions on conservation - Status of biodiversity conservation in India. *Ex situ* & *In situ* conservation. Institutions and their role in conservation - Natural history museums & collections – ZSI – BSI - FRI - CMFRI - Applications of remote sensing.

UNIT V **(12 Hours)**

Role of NGOs in conservation: International NGOs – UNEP – GEF – WCS - Bird Life International - Important NGOs in India and their contributions – WWF – ATREE – BNHS - WTI and Kalpavriksha - Important NGO movements - Chipko movement - Silent valley - Narmada Bachao Aandholan - Pani Panchayats - Seed Movement.

Laboratory Exercises

1. Random sampling, sample size, quadrat, transect and point method for the study of community structure.
2. Determination of frequency, density and abundance of different species present in the community.
3. Determination of species richness and evenness.
4. Study the dispersion of the species by calculating mean and variance of species.
5. Estimating Alpha (α), Beta (β) and Gamma (γ) diversity.
6. Estimating species diversity by Shannon and Simpson's Index
7. Documentation of Avifauna within the college campus and adjoining areas.
8. Preparation of field data sheet.
9. Visit to Zoos, Sanctuaries and National Park.
10. GPS field data collection and import to computer.

Learning Resources

Text Book

1. Krishnamurthy KV (2009). An Advanced Textbook on Biodiversity Principles and practice. Oxford & IBH publishing Co Pvt. Ltd., New Delhi.

References

1. Ghosh A (2009). Biodiversity Conservation, APH Publications, New Delhi.
2. Sharma PD (2005). Ecology and Environment. Rastogi Publication, New Delhi

3. Dutta A (2001). Biodiversity and Ecosystem Conservation. Kalpaz Publications, New Delhi.
4. Negi SS (1993). Biodiversity and its Conservation in India. Indus Publications, New Delhi.
5. Ladle RJ (2009). Biodiversity and Conservation: Response to biodiversity loss. Taylor and Francis, UK.

Websites/ e-Learning Resources

1. https://ngofeed.com/ngos-in-conservation-and-biodiversity-protection/
2. www.iucnredlist.org
3. https://worldwildlife.org
4. https://www.iucn.org/our-work/biodiversity
5. https://www.bnhs.org/
6. https://www.atree.org/
7. https://www.iucnredlist.org/
8. https://www.tigersafariindia.com/blog/top-5-wildlife-conservation-schemes-of-india/

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	2	2	2	2	3	3	2	3
CO 2	3	2	2	2	3	2	3	3	2	3
CO 3	3	3	2	2	3	3	3	3	3	3
CO 4	3	2	2	2	3	3	3	3	3	3
CO 5	3	3	2	2	3	3	3	3	3	3
Average	3	2.6	2	2	2.8	2.6	3	3	2.6	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3402	Project	Core	4	4

In this course, small teams of students will be assigned a research topic based on academic and/or societal needs in various research areas such as entomology, ornithology, microbiology, biochemistry, molecular biology, immunology and biotechnology. It provides ample opportunities to address the query topic by designing and executing a work chart, generating & compiling data, interpreting, discussing and reporting the results in a scientific format.

Course Outcomes:

At the end of the course, students will be able to

CO1: Identify a specific research query in a subject area.

CO2: Formulate work plan to generate data on the query topic.

CO3: Examine the validity of the work plan and data generated.

CO4: Collect the data and interpret the result.

CO5: Report the result in appropriate scientific forum.

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3	3	3	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3404	Bioinformatics (TcL)	DSE	5 (3+2)	4

This course deals with the basics of computer including internet, search engines and web browsers. It gives an overview of available bioinformatics resources such biological data types, databases, sequence analysis and alignment tools. It also emphasizes on phylogenetic tree construction methods.

Course Outcomes:

CO1: Classify computers and explain the components.

CO2: Summarize the basics of internet, it's uses and threats.

CO3: Generate biological data and analyse the types of data.

CO4: Explain the types of biological database.

CO5: Describe the significance of sequence alignments and perform sequence analysis.

UNIT I **(9 Hours)**

Introduction to computer: Functions – features – components and classification of computer –operating systems – software and hardware - data storage and retrieval.

UNIT II **(9 Hours)**

Basics of internet: Electronic mail –IP address -world wide web –HTML –URL- Domain name- Web browsers –search engines- online services and Internet service providers-servers-uses of internet- computer viruses.

UNIT III **(9 Hours)**

Bioinformatics & biological data: Components and applications of bioinformatics - relation with molecular biology, generation of biological data –data types –Gene expression data –metabolic pathways and molecular interactions-mutations and polymorphisms-genetic maps –physicochemical properties.

UNIT IV **(9 Hours)**

Biological databases: Classification - nucleic acid databases- NCBI, DDBJ and EMBL–protein databases (primary, composite & secondary) –specialized genome databases -SGD, TIGR and ACeDB –structural databases -CATH and SCOP.

UNIT V **(9 Hours)**

Sequence analysis and alignments Sequence alignments – significance –global – local – pair wise -BLAST & FASTA- multiple sequence alignment –Clustal W **–**

visualization and analysis tools -RASMOL - SPDB –sequence viewers – 3D structure viewers –phylogenetic tree.

Laboratory Exercises

1. Exploring computer components, internet and World Wide Web.
2. Web browsing and email setup.
3. Bibliographic databases and full text research articles retrieval (PUBMED).
4. Sequence retrieval from GenBank.
5. Identify open reading frames using ORF finder.
6. Sequence alignment –BLAST.
7. Local Alignment using EMBOSS water.
8. Global Alignment using EMBOSS needle.
9. Multiple sequence alignment – Clustal W
10. Phylogenetic tree construction.
11. Protein sequence and structure databases- Uni Prot KB, PDB.
12. Visualization of protein structure- RasMol, SPDBV.
13. Identification of restriction map sites using software.

Learning Resources

Text Book

1. Ignacimuthu S (2005). Basic Bioinformatics. 2nd Edition, Narosa Publishing House, New Delhi.

References

1. Teresa K., David A and Parry-Smith (2001). Introduction to Bioinformatics. 1st Edition, Pearson Education, New Delhi.
2. Lesk AM (2002). Introduction to Bioinformatics. 1st Edition, Oxford University Press, USA
3. Claverie JM and Notredame C (2006). Bioinformatics for Dummies. 2nd Edition, John Wiley & Sons, Inc., USA.
4. Xiong J (2006). Essential Bioinformatics. Cambridge University Press, New York.

Websites/ e-Learning Resources

1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBB1609.pdf
2. https://libguides.bodleian.ox.ac.uk/bioinformatics/online-resources

CO-PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	2	3	3	3	3	3	2	3	2
CO 2	3	2	3	3	3	3	3	2	3	2
CO 3	3	2	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	3	3	3
Average	3	2.4	3	3	3	3	3	2.6	3	2.6

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3406	Fish Farming (TcL)	DSE	5 (3+2)	4

This course is designed to make the students know about the scope of aquaculture, principle of site selection, preparation of fish pond, seed collection and rearing of young one. It also deals with fish feed preparation, ornamental fish rearing, diseases management and control measures.

Course Outcomes:

At the end of the course, students will be able to

CO1: Summarize the basic concepts of aquaculture.

CO2: Examine the pond preparation for fishes rearing.

CO3: Describe the on-seed collection methods and rearing of fish.

CO4: Employ the methods of rearing ornamental fishes.

CO5: Explain fish diseases and their management.

UNIT I **(9 Hours)**

Introduction to Aquaculture: Scope of aquaculture - General characters and desirable characters of fish for culture. Freshwater aquaculture - brackish water aquaculture - mariculture - metahaline culture. Feeding habits, growth rate, and reproductive behaviour of Common carp - Chinese carp - Indian major and minor carps - Tilapia - Trout- Catfishes – Sahar - Silver barb.

UNIT II **(9 Hours)**

Pond preparation: Types of fish ponds for culture practice. Topography- site selection - water quality - soil condition – structure and construction - inlet and outlet. Water quality management. control of parasites, predators and weeds in culture ponds.

UNIT III **(9 Hours)**

Seed collection and rearing of fish: Procurement of seed from natural resources - collection methods and segregation. Artificial seed production - Breeding under control conditions- induced breeding - larval rearing- packing and transportation. Fish feed - artificial feeds- types- feed formulation - feeding methods. Live feed - Microalgae, Rotifer - Artemia and their culture practices.

UNIT IV **(9 Hours)**

Ornamental fish culture: Biology- sexing- courtship- feeds and feeding- breeding

and mass production of gold fish- gourami- angel fish- koi carps. Rearing of marine anemone fish and damsel fish. Packing and transport methods. Maintaining pet shops.

UNIT V **(9 Hours)**

Disease control and management: Common fish diseases and parasites: causative organisms- symptoms - control measures of Saprolegniasis - Tail rot/fin rot - White spot disease – Dactylogyrosis - Argulosis.

Laboratory Exercises

1. Identification of commercially important fresh water fishes.
2. Gut content analysis of fish.
3. Morphometric measurement of fishes.
4. Preparation of fish pituitary extract.
5. Identification of spawn, fry and fingerlings of Rohu, Catla and Mrigal
6. Identification of fish diseases and parasites
7. Analysis of pH, salinity and DO in aquarium and pond.
8. Packaging and transport of fishes.
9. Maintaining of ornamental fish.
10. Preparation of artificial feed for fish.
11. Field visit to fish pond and fish farm.

Learning Resources

Text Books

1. Maitre-Alain T and Piednoir C (2009). Aquariums: The Complete Guide to Freshwater and Saltwater Aquariums, Firefly Book Publisher, Pennsylvania State University, Pennsylvania.
2. Yadav BN (2006). Fish and fisheries, 4th Edition, Daya Publishing house, Delhi.

References

1. Cato JC and Brown CL (2003). Marine ornamental species: collection, culture and conservation. Blackwell Publishing, Ames, Iowa.
2. Cliff Harrison (1980). A colour guide to Tropical Fish, Chartwell Books, INC, Cerkshire, Printer, Hon Kong.
3. Jingran VG (1991). Fish and Fisheries in India, Hindustan Publishing Company, Delhi.
4. Santhanam P., Sukumaran N and Natarajan P (1999). A manual of freshwater aquaculture, Oxford & IBH Publishing Company Pvt., Ltd., New Delhi.

5. O'Connell RF (1977). The Freshwater Aquarium. Arco Publishing Company, INC New York.

Websites/ e-Learning Resources

1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004150935214277sptrivedi_MAINTENANCE_OF_FISHES.pdf
2. https://prgc.ac.in/uploads/study_material/Ornamental%20fisheries-converted.pdf573.pdf
3. https://www.fao.org/4/ac182e/AC182E04.htm
4. https://elearning.raghunathpurcollege.ac.in/files/4B9DCF9D16060599490.pdf

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	1	2	3	3	2	1	1	2	1
CO 2	3	1	3	2	2	1	2	1	2	1
CO 3	3	3	1	3	3	2	2	2	1	2
CO 4	2	1	2	2	3	1	3	1	2	1
CO 5	2	3	2	2	3	2	3	2	2	2
Average	2.6	1.8	2	2.4	2.8	1.6	2.2	1.4	1.8	1.4

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3302	Poultry Farming	GE	4	3

This is an economically important and job-oriented course. This course covers the principle and practices of poultry farming, from breed selection and nutrition to health management and marketing. It also deals with biology and behaviour of poultry, housing and equipment needs, feed formulation and disease prevention and control, egg production management and Entrepreneurial skills.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the growth of poultry industry in India and explain various types of housing and systems of poultry farming.

CO2: Identify Indian and exotic breeds and techniques needed for poultry management.

CO3: Assess energy requirements, feed formulations and management.

CO4: Evaluate various poultry diseases and health management.

CO5: Examine the difficulties in handling of hatching eggs, sexing of chicks and recycling of poultry waste.

UNIT I **(12 Hours)**

Introduction to Poultry Farming: Scope - definition - past and present scenario of poultry industry in India - poultry housing - poultry houses - systems of poultry farming.

UNIT II **(12 Hours)**

Harvesting of Egg and Sanitation: Selection, care and handling of hatching eggs – egg structure - egg testing - methods of hatching - brooding and rearing - sexing of chicks - farm and water hygiene - recycling of poultry waste.

UNIT III **(12 Hours)**

Management of Poultry: Indian and exotic breeds - management of chicks – culling - debeaking - growers and layers - management of Broilers- winter and summer management.

UNIT IV **(12 Hours)**

Nutrition Management: Poultry feed management - nutrient requirements for different stages of layers and broilers - feed formulation - methods of feeding.

UNIT V **(12 Hours)**

Health Management: Poultry diseases - viral (Ranikhet and fowl pox)– bacterial (fowl cholera and avian tuberculosis) – fungal (Aspergillosis and Zygomycosis) - parasitic (ascariasis and coccidiosis) – symptoms -control – management. Vaccination programme – marketing – Entrepreneurship – funding agencies – visit to poultry farm.

Learning Resources

Text Books

1. Gnanamani MR (2003). Modern Aspects of Commercial Poultry Keeping. 9th Edition, Giri Publications, Madurai.
2. Sreenivasaiah PV (2005). Text book of Poultry Science. 1st Edition. Write & Print Publications, New Delhi.

References

1. Chauhan HVS and Roy S (2007). Poultry Diseases, Diagnosis and Treatment. 3rd Edition, New Age International, New Delhi.
2. Jaiswal V and Jaiswal KK (2014). Economic Zoology, PHI Learning Private Limited, New Delhi.
3. Jull MA (1976). Poultry Husbandry. 3rd Edition, Tata McGraw Hill Publishing Company Ltd. New Delhi.

Websites/ e-Learning Resources

1. http://ecoursesonline.iasri.res.in/course/view.php?id=335
2. https://www.embibe.com/exams/poultry/
3. http://www.agritech.tnau.ac.in/expert_system/poultry/Poultry%20House%20Construction.html
4. https://www.studocu.com/in/document/maharani-lakshmi-ammani-womens-college/economic-zoology/poultrynotes-poultry-farming-classification-of-poultry-breeds-based-on-origin-diseases/77240782
5. https://www.aakash.ac.in/important-concepts/biology/poultry-farming
6. http://www.agritech.tnau.ac.in/expert_system/poultry/Disease%20Control%20And%20Management.html
7. https://www.fao.org/4/t0756e/T0756E08.htm

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	2	3	1	3	3	2	2	1
CO 2	3	2	2	3	1	2	3	2	1	1
CO 3	3	2	2	3	1	1	2	2	1	1
CO 4	3	2	2	3	1	1	2	1	2	3
CO 5	3	2	2	3	1	2	3	1	2	2
Average	3	2	2	3	5	1.4	2.6	1.6	1.6	1.6

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3304	**Agricultural Entomology**	**GE**	**4**	**3**

Agricultural entomology is the study of insects associated with various aspects of agriculture. It deals with the study of insect identification, both beneficial and detrimental insects, and dynamics of pest control.

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the basic concepts of entomology and observe the pest status of agriculture.

CO2: Differentiate and classify the various groups of beneficial insects.

CO3: Assess the pest status in agriculture and control measures.

CO4: Analyse the various control methods and outcomes of integrated pest management.

CO5: Examine the economic importance of agricultural insect species.

UNIT I **(12 Hours)**

Identification & Preservation: Outline classification - identification (up to order level – any five) - Insect development and metamorphosis – types - hormonal control - Larvae - pupae. Methods of collection - mounting - preservation of insect pests.

UNIT II **(12 Hours)**

Beneficial insects: Scavenger: maggot flies. Pollinator: honey bee. Predator: dragon fly. Parasite: lady bird. Biological control: weed killers.

UNIT III **(12 Hours)**

Insect pest: Kinds of pests, causes - pest status, factors causing pest outbreaks - IPM – Pheromones – antifeedants - repellents - biopesticide - Insect vectors of plant diseases.

UNIT IV **(12 Hours)**

Pest control: Physical – Chemical – Mechanical – Biological - Integrated pest management – Pesticide application equipment – safety precautions.

UNIT V **(12 Hours)**

Insect pests in Agriculture: Pests of stored grains – prevention - curative methods. Life cycle - control measure of Rice pest -*Tryporyza incertulas.* Cotton pest-

Helicoverpa armigera. Sugarcane pest- *Scirpophaga nivella.* Coconut pest – *Oryctes rhinoceros.* Migratory locust- *Locusta migratoria*.

Learning Resources

Text Books

1. David B and Ananthakrishnan TN (2006). General and Applied Entomology, 2nd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, India.
2. David B and Ramamurthy VV (2012). Elements of Economic Entomology, 7th Edition, Namrutha publications, Chennai.
3. Awasthi VB (2012). Introduction to General and Applied Entomology, 3rd Edition, Scientific Publishers.

References

1. Abhishek Shukla D (2009). A Handbook of Economic Entomology, Vedamse Books, New Delhi.
2. Ministry of Agriculture and Government of India (1995). Manual on Integrated Pest Management in Rice and Cotton.
3. John William S (1995). Management of Natural Wealth, Loyola College Publications, Chennai.

Websites/ e-Learning Resources

1. http://www.fao.org
2. http://flybase.bio.indiana.edu/
3. http://www.ipm.ucdavis.edu
4. http://www.ent.iastate.edu/list/

CO -PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	3	2	2	3	2	1	3	2	2	1
CO 2	3	3	2	2	2	1	2	3	1	1
CO 3	3	3	3	2	2	1	2	2	1	3
CO 4	3	2	2	2	2	1	2	3	2	3
CO 5	3	2	3	2	2	1	2	2	1	3
Average	3	2.4	2.4	2.2	2	1	2.2	2.4	1.4	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO3266	Professional Competency Skill	SEC	3	2

This course aims at enhancing the students' capabilities in passing competitive examinations intended for admissions into higher education and appointments in government and non-government organizations. This course provides in-depth information in subjects of zoology and intense practice in writing examinations.

Course Outcomes:

At the end of the course, students will be able to

CO1: Describe the fundamentals and applications of concepts in zoology.

CO2: Apply the acquired knowledge gained to pass competitive examinations.

CO3: Identify newer areas of development in zoology and design strategies towards them.

CO4: Use of scientific principle in solving higher order problems.

CO5: Develop competency for writing competitive examinations.

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3	3	3	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Department of Zoology (UG)

Value Added Courses

w.e.f. 2024-2025

Sem	Course Code	Course Title	Hours/Wk.	Credits
2	24ZOO122V	Personal Hygiene	2	2
3	24ZOO221V	Shrimp Culture	2	2
5	24ZOO321V	First Aid and Safety	2	2

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO122V	**Personal Hygiene**	**VAC**	**2**	**2**

The course in Personal Hygiene deals with common ailments and general health care measures. It also discusses about personality care and personnel presentability in specific forums and society at large.

Course Outcomes

At the end of the course, students will be able to

CO1: Outline the needs and general methods of personal hygiene management.

CO2: Explain the common problems of mouth and eyes with their remedies.

CO3: Summarize the general problems and health care measures of ear and hair.

CO4: Describe the skin, foot and nail problems and their management.

CO5: Discuss the routines and need for washing and good life style habit.

UNIT I **(6 Hours)**

Introduction to Personal Hygiene: Hygiene – Definition – Personal - Community – conventional hygiene management methods-turmeric-neem-mud - Soap – the magic bullet for hygiene.

UNIT II **(6 Hours)**

Oral and Eye care: Oral problems – bad breath- dental erosion – tooth cavity & decay- prevention methods. Ocular problems-eye strain- red and dry eyes-problems due to contact lenses- management methods.

UNIT III **(6 Hours)**

Ear and Hair care: Ear problems – head phones - mobile phones – ear wax – general management of ear hygiene. Hair care – factors affecting hair health– general management of hair health.

UNIT IV **(6 Hours)**

Skin, Foot and Nail care: skin problems – dry skin - contact dermatitis - Psoriasis – general skin care procedures. Importance of foot and nail care - factors affecting hair health – common ailments of foot-arthritic feet- diabetic foot ulcer- Athlete's foot-nail disorders- ingrowing toe nails- onychomycosis – general foot and nail hygiene measures.

UNIT V **(6 Hours)**

Washing and bathing practices: Importance of washing – daily routines of bathing – hand washing-need-methods – soap, shampoo, hand & body wash liquids – Personality and presentability.

Learning Resources

Text Books

1. Dingwall L. (2010). Personal Hygiene Care. Wiley-Blackwell Publication, UK.
2. Overton F. (1913). Personal Hygiene. American Book Company, USA.

References

1. Singh B. (2019). Personal Health and Hygiene. Friends Publication, India.
2. Smith V. (2008). Clean: A history of personal hygiene and purity. Oxford University Press, UK.
3. Lecture Notes. (2004). Personal Hygiene for Health Extension Workers. Jimma University in collaboration with Ethiopia Public Health Training Initiative, The Carter Centre, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education.

Websites/ e-Learning Resources

1. https://plt4m.com/blog/personal-hygiene-lesson-plans/
2. https://www.slideshare.net/slideshow/personal-hygiene-232661872/232661872

CO- PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	2	2	3	3	3	3
CO2	3	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	2	2	3	3	3	3
CO4	3	3	3	3	2	2	3	3	3	3
CO5	3	3	3	3	2	2	3	3	3	3
Average	3	3	3	3	2	2	3	3	3	3

High correlation – 3, Medium correlation – 2, Low correlation – 1, No correlation - '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO221V	Shrimp Culture	VAC	2	2

This course aims at providing students with a knowledge in agriculture, national economy, nutritional security, employment generation and foreign exchange. This course is vested with responsibilities in guiding and coordinating shrimp culture practices.

Course outcomes:

At the end of the course, students will be able to

CO1: Gain in depth knowledge and field exposure on sustainable shrimp culture practices.

CO2: Learn effectively the shrimp value added products.

CO3:Create basic understanding on pond construction and water quality management.

CO4: Provide holistic knowledge on shrimp feeding and disease management.

CO5 Familiarize the students with concepts and principles of Harvest, postharvest technology and non-government organizations.

UNIT I **(6 Hours)**

Sustainable Shrimp farming: Present global and national scenario – Extensive - semi- intensive - intensive - super intensive culture practices – Freshwater - brackish water - marine shrimps - *Penaeus monodon - P. indicus, Macrobrachium rosenbergii - M. malcolmsonii.*

UNIT II **(6 Hours)**

Shrimp Value added products: Value added products - Shrimp chitin - chitinosan-biomedical application - food flavour –tiny prawns and non-penaeid prawns – protein extract -shrimp - glucosamine hydrochloride, glucosamine sulphate.

UNIT III **(6 Hours)**

Pond construction and water quality management: Site selection - designing - components - construction of tanks - pump and pipeline systems - water intake and outlet design - aerator and fabrication - water quality analyses.

UNIT IV **(6 Hours)**

Feeding and disease management: Types of feed dry and non-dry - Feeding practices - schedule - feed economics and evaluation (FCR, PER and NPU) - feed additives – Viral-white spot syndrome (WSSV) bacterial - luminous vibriosis and

fungal –Black gill diseases - pathogens - clinical symptoms - diagnosis - control measures.

UNIT V **(6 Hours)**

Harvest, post-harvest technology and marketing management: Harvesting techniques - shrimp grading and quality evaluation - chilling and freezing techniques - packaging and marketing - marketing channels and problems - role of co-operative societies - government - non-government organizations.

Learning Resources

Textbook

1. Rao PS (1983). Fisheries economics and management in India, Pioneer publishers.

References

1. Bliss DE (1983). The biology of Crustacea, Vol.1-10, Academic press, New York.
2. MPEDA (Marine Products Export and development Authority), (1996). A manual of shrimp farming, MPEDA, Kochi, India
3. CMFRI (1982). Manual of research methods for fish and shell fish nutrition. CMFRI, special publication No.8, CMFRI, Cochin, India.

Websites/e-Learning Resources

1. https://nfdb.gov.in/PDF/Fish%20&%20Fisheries%20of%20India/1.Fish%20and%20Fisheries%20of%20India.pdf
2. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004092006210960serajuddin_Prwan.pdf
3. https://www.globalseafood.org/advocate/value-added-shrimp-products/
4. https://www.gov.nl.ca/ecc/files/waterres-waste-groundwater-guidelines-for design-constr-oper-wss.pdf
5. https://ccelms.ap.gov.in/adminassets/docs/12112020072437-2.3.3.2.1.4_Aquafeed_-_types_of_feeds_feeding_methods_and_FCR-_Notes.pdf
6. ksadyayinevi.com/wp-content/uploads/2023/10/advancements-in-aquaculture-sustainable-practices-innovations-and-applications.pdf
7. https://krishi.icar.gov.in/jspui/bitstream/123456789/70443/1/5.pdf
8. https://www.alagappauniversity.ac.in/links/docs/cdc/34.pdf

CO- PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	2	2	3	2	2	2	2
CO2	3	3	2	2	2	3	2	2	2	2
CO3	3	3	2	2	2	3	2	2	2	2
CO4	3	3	2	2	2	3	2	2	1	2
CO5	3	3	2	2	2	3	2	1	1	2
Average	3	3	2	2	2	3	2	2	1.6	2

High Correlation -3, Medium correlation -2, Low Correlation-1, No Correlation – '-'

Course Code	Name of the Course	Category	Hours/Wk.	Credits
24ZOO321V	First Aid and Safety	VAC	2	2

This course includes basic first aids, emergency response, burns, wound & injuries, poisoning by swallowing, gases, injections and animal bites.

Course Outcomes:

At the end of the course, the student should be able to

CO1: Discuss the basic life support skills.

CO2: Describe the first aid during emergency.

CO3: Identify the burns and wound management.

CO4: Explain first aid in wounds and injuries.

CO5: Evaluate the symptoms and first aid in poisoning.

UNIT I **(6 Hours)**

First aid basics: first aid - importance- first aider- laws- contents of an ideal - first aid kit – emergency.

UNIT II **(6 Hours)**

Emergency response: CPR - newborns – infants - recovery position - first aid drowning - fractures of bones - causes - types of fractures and dislocation.

UNIT III **(6 Hours)**

First aid in burns: Types of burns - danger of burns - dry burns – scalds - electrical burns - chemical burns – sunburn – fire burn.

UNIT IV **(6 Hours)**

First aid in wounds and injuries: Types of wounds- small cuts – abrasions - head injury – nosebleed - bleeding gum - bleeding from varicose veins. Shocks- causes of shock and its first aid.

UNIT V **(6 Hours)**

First aid in poisoning: poisoning by swallowing – gases – injections - skin absorption. Animal bites - snake bites and insect stings.

Learning Resources

Text Book

1. Andrew (2002). First Aids Manual, British Red Cross society.

References

1. Red Cross First Aid/CPR/AED Instructor Manual.
2. Finkelhor D (2009). The prevention of childhood sexual abuse. Durham, NH: Crimes against Children Research Center.
3. Schwiegershausen E (2015). The Cut. www.thecut.com/2015/05/most-women-are-catcalled-before-they-turn-17.html

Websites/e-Learning Resources

1. https://vikaspedia.in/health/first-aid/first-aid-techiques-for-school-children/basics-of-first-
2. https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online
3. https://www.nhs.uk/conditions/burns-and-scalds/treatment/
4. https://www.moh.gov.sa/en/HealthAwareness/EducationalContent/Firstaid/Pages/017.aspx
5. https://www.mayoclinic.org/first-aid/first-aid-poisoning/basics/art-20056657

CO- PO Mapping

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	2	3	2	3	3
CO2	3	3	2	3	3	2	3	2	3	3
CO3	3	3	3	3	3	2	3	2	3	3
CO4	3	2	3	3	2	2	3	2	3	3
CO5	3	2	3	3	2	2	3	2	3	3
Average	3	2.6	2.8	3	2.6	2	3	2	3	3

High Correlation -3, Medium correlation -2, Low Correlation-1, No Correlation – '-'