Department of Zoology (PG)

SYLLABUS AND REGULATIONS

Under

OUTCOME-BASED EDUCATION

2020

(Effective for the Batch of Students Admitted from 2020-2021)

AUXILIUM COLLEGE (Autonomous)

(Accredited by NAAC with A+ Grade with a CGPA of 3.55 out of 4 in the 3rd Cycle)

Gandhi Nagar, Vellore-632 006

AUXILIUM COLLEGE (Autonomous), Gandhi Nagar, Vellore-632006.
(Accredited by NAAC with A^+ Grade with a CGPA of 3.55 out of 4 in the 3rd cycle)

OUTCOME BASED EDUCATION
M.Sc. ZOOLOGY
(Effective for those admitted from the Academic Year 2020 – 2021)

Structure of the Course and Scheme of Examinations:

Sem	Paper Code	Title	Hours/ Week	Exam Hours		Credits	Marks
				Th	Pr		
I	PCZOA20	Phylogeny of Invertebrates and Chordates.	7	3	-	4	40+60
	PCZOB20	Molecular Biology and Genetics.	6	3	-	5	40+60
	PCZOC20	Applied Biotechnology and Microbiology.	6	3	-	4	40+60
	PCZOG20	Core Practical I	3	-	-	-	-
	PCZOH20	Core Practical II	3	-	-	-	-
	PEZOA20	Elective 1A: Biostatistics and Computational Biology.	5	3	-	5	40+60
	PEZOB20	Elective 1B: Computational Methods for Sequence Analysis.					
	PIZOA20	Independent Elective IA: Pet Keeping.	-	-	-	2	100
	PIZOB20	Independent Elective IB: Biophysics.					
		Total	**30**	**-**	**-**	**18**	**400**
II	PCZOD20	Research Methodology	6	3	-	4	40+60
	PCZOE20	Applied Entomology	5	3	-	4	40+60
	PCZOF20	Biodiversity and Wildlife Conservation	6	3	-	4	40+60
	PCZOG20	Core Practical I	3	-	4	4	40+60
	PCZOH20	Core Practical II	3	-	4	4	40+60
	PEZOC20	Elective II A: Biochemistry	5	3	-	5	40+60
	PEZOD20	Elective II B: Endocrinology					
	PNHRA20	Human Rights	2	3	-	2	40+60
	PIZOC20	Independent Elective IIA: Animal Husbandry	-	-	-	2	100
	PIZOD20	Independent Elective IIB: Eco Energetics and Ecological Methods					
		Total	**30**			**27**	**700**

III	PCZOI20	Environmental Biology	7	3	-	4	40+60
	PCZOJ20	Limnology and Toxicology	6	3	-	4	40+60
	PCZOK20	Animal Behaviour	6	3	-	4	40+60
	PCZOL20	Summer Project	-	-	-	-	100
	PCZOP20	Core Practical III	3	-	-	-	-
	PCZOQ20	Core Practical IV	3	-	-	-	-
	PEZOE20	Elective III A: Clinical Laboratory Techniques	5	3	-	5	40+60
	PEZOD20	Elective III B: Fisheries Science					
	PGTRA15	Teaching and Research Aptitude	5	3	-	3	40+60
	PIZOE20	Independent Elective III A: Radiation Biology	-	-	-	2	100
	PIZOF20	Independent Elective IIIB: Dairying					
		Total	**30**			**20**	**600**
IV	PCZOM20	Physiology and Endocrinology	7	3	-	4	40+60
	PCZON20	Developmental Biology and Immunology	6	3	-	4	40+60
	PCZOO20	Evolution	6	3	-	4	40+60
	PCZOP20	Core Practical III	3	-	4	4	40+60
	PCZOQ20	Core Practical IV	3	-	4	4	40+60
	PEZOE20	Elective IV A: Fishery Biology	5	3	-	5	40+60
	PEZOF20	Elective IV B: Aquaculture and Farm Management					
	PIZOG20	Independent Elective IV A: Biosystematics	-	-	-	2	100
	PIZOH20	Independent Elective IVB: General Psychology					
	PIZOI20	Independent Elective IVC: Animal Care					
		Total	**30**	**-**	**-**	**25**	**600**
		Grand Total				**90**	**2300**
		Teaching and Research Aptitude	**5**	**3**	**-**	**3**	**100**
		Summer Project	**-**	**-**	**-**	**3**	**100**
		Independent Elective	**-**	**-**	**-**	**8**	**-**

PROGRAMME OBJECTIVES:

On completion of the PG Programme, students will be able to:

PO1: Attain an in-depth knowledge in the respective domains augmented through self-learning.

PO2: Assimilate and apply principles and concepts towards skill development and employability.

PO3: Apply critical and scientific approaches to address problems and find solutions.

PO4: Develop research skills through multi/inter/trans-disciplinary perspectives.

PO5: Integrate issues of social relevance in the field of study.

PO6: Persist in life-long learning for personal and societal progress.

PROGRAMME SPECIFIC OBJECTIVES:

As Masters in Zoology, graduates will:

PSO1: Have in-depth knowledge on animal diversity from acellular to multicellular level of organization and apply the learnt concepts in all the fields of Zoology.

PSO2: Demonstrate expertise in practical procedures and handling laboratory equipments/ instruments. Effective communicator, novel thinker to address the emerging needs.

PSO3: Be abled leaders with team spirit, analytical thinking and completion of work in academic, on-field and research areas.

PSO4: Gain ability to develop research aptitude/creative thinking in contemporary and current fields of interest.

PSO5: Conduct their duty with at most honesty and adhere to ethical protocols. On the whole, be agents of social transformation to up bring their society at large.

PSO6: Be technically sound in applying the Information technology and will be lifelong learners in updating to the current advancements in their respective fields.

PSO/PO	**PO**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
PSO1	H	H	H	H	H	H
PSO2	H	H	H	H	H	H
PSO3	H	H	H	H	H	H
PSO4	H	H	H	H	H	M
PSO5	H	H	H	H	H	H
PSO6	H	H	H	H	H	H

SEMESTER I

PCZOA20 - PHYLOGENY OF INVERTEBRATA AND CHORDATA

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I	PCZOA20	Phylogeny of Invertebrata and Chordata	Theory	Core	7	4	100

Objectives:

- To enlighten the students with adequate scientific details on origin, evolution, adaptive radiations and Phylogenetic relationships of Invertebrates and Chordates.

Course Outcomes:

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

CO1: Analyze the taxonomic status of Invertebrates, its origin and Evolution

CO2: Categorize Respiratory, Circulatory and Urinogenital system of various classes of vertebrates.

CO3: Justify adaptive radiations of annelids, molluscs, pisces, amphibians and mammals.

CO4: Explain salient features of invertebrate and chordates.

CO5: Distinguish structural, functional and phylogenetic significance of minor phyla.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	M	H
CO2	H	H	M	H	M	H
CO3	H	H	M	H	M	H
CO4	H	H	M	H	M	H
CO5	H	H	M	H	M	H

Unit 1: **(21 Hours)**

1.1: Phylogenetic tree of Invertebrates. (K1, K2, K3, K4, K5)

1.2: Origin and evolution of Metazoan theories - Haeckal, syncytial, colonial, Hadzi's theory. (K1, K2, K3, K4, K5)

1.3: Coelom- classification, theories - Enterocoel, Gonocoel, Nephrocoel and Schizocoel. (K1, K2, K3, K4, K5)

1.4: Grades of Symmetry; Metamerism - classification, theories- Pseudometamerism, Cyclomerism, corm theory, Embryological theory. (K1, K2, K3, K4, K5)

1.5: Origin of Cephalization; Jawed vertebrates- origin, class- Acanthodians. (K1, K2, K3, K4, K5)
1.6: Placoderms – order - Arthrodires, Ptyctodonts, Phyllolepids, Antiarchs, Petalichthdys, Rhenanids, Palaeospondylus. (K1, K2, K3, K4, K5)

Unit 2: (21 Hours)

2.1: Comparative anatomy of Respiratory System- Respiratory organs - Gills, Lungs. (K1, K2, K3, K4, K5)
2.2: Circulatory system - Evolution of Heart. (K1, K2, K3, K4, K5)
2.3: Modification of aortic arches. (K1, K2, K3, K4, K5)
2.4: Modifications of veins. (K1, K2, K3, K4, K5)
2.5: Urino-genital system - Origin and structure of Kidney across vertebrates. (K1, K2, K3, K4, K5)
2.6: Gonads and their ducts. (K1, K2, K3, K4, K5)

Unit 3: (21 Hours)

3.1: Adaptive radiations in: Annelids - Polychaete, Hirudinae. (K1, K2, K3, K4, K5, K6)
3.2: Molluscs – Gastropods, Polyplacophora, Bivalves, Scaphopods, Cephalopods. (K1, K2, K3,K4, K5, K6)
3.3: Fishes- Earliest Elasmobranchs, Teleost - Body forms, Feeding habit.(K1,K2,K3,K4,K5, K6)
3.4: Protective mechanism, Bioluminescence. (K1, K2, K3, K4, K5)
3.5: Adaptive radiation in Amphibians - Limbless Amphibians, Salamanders and Newts, Frogs and Toads. (K1, K2, K3, K4, K5)
3.6: Adaptive radiation in Mammals - Terrestrial; Arboreal; Flying; Aquatic. (K1, K2, K3, K4, K5)

Unit 4: (21 Hours)

4.1: Torsion in Mollusca. (K1, K2, K3, K4, K5)
4.2: Larval forms in Echinoderms and their significance. (K1, K2, K3, K4, K5)
4.3: Origin of Tetrapod limbs. (K1, K2, K3, K4, K5, K6)
4.4: Extinct Reptiles. (K1, K2, K3, K4, K5)
4.5: Archaeopteryx and affinities. (K1, K2, K3, K4, K5)
4.6: Egg laying Mammals. (K1, K2, K3, K4, K5)

Unit 5: (21 Hours)

5.1: Structural, functional and Phylogenetic significance of Lophophora. (K1, K2, K3, K4, K5)
5.2: Structural, functional and Phylogenetic significance of Phoronida. (K1, K2, K3, K4, K5)
5.3: Structural, functional and Phylogenetic significance of Rotifera. (K1, K2, K3, K4, K5)
5.4: Structural, functional and Phylogenetic significance of Sipunculida. (K1, K2, K3, K4, K5)
5.5: Structural, functional and Phylogenetic significance of Chaetognatha. (K1, K2, K3, K4, K5)
5.6: Structural, functional and Phylogenetic significance of Phogonophora. (K1, K2, K3, K4, K5)

Books Study for Reference:

Textbooks:

1. Jordan E.L, Verma P.S 1997- Invertebrate Zoology 14ed- S. Chand and company limited.
2. Kotpal R.L 1997- Modern textbook of Zoology- Invertebrates 7ed- Rastogi Publications.

Reference Books:

1. Meglitsch P 1967- Invertebrate Zoology - Oxford University Press.
2. Barrington E.J.W 1979- Invertebrate structure and function 2ed – The English Language Book Society and Nelson (ELBS)
3. Robert D. Barnes 1981- Invertebrate Zoology 4ed- Holt- Saunders International Editions.
4. Marshall A.J and Williams W.D 1976– Textbook of Zoology Vol I: Invertebrates 7ed- ELBS.
5. Edwin H. Colbert 1969- Evolution of Vertebrates 2ed- Wiley Eastern Private Limited.
6. Harvey Pough F, John B. Heiser and William N. McFarland 1990- Vertebrate life 3ed – Maxwell Macmillan International editions.
7. Kenneth V. Kardong 2011- Vertebrates- Comparative anatomy, functions, evolution 4ed- Tata McGraw Hill Editions.
8. Young J.Z 1981- The life of vertebrates 3ed- ELBS.
9. George C. Kent 1987- Comparative anatomy of Vertebrates 6ed-Times Mirror/Mosby College Publishing.
10. Vasanthika Kashyap 1997- Life of Invertebrates 2ed- Vikas Publishing house pvt. Limited.

E-Resources:

http://www.earthlife.net/begin.
http://faunaofindia.nic.in
https://www.civilserviceindia.com

SEMESTER I

PCZOB20 - MOLECULAR BIOLOGY AND GENETICS

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I	PCZOB20	Molecular Biology and Genetics	Theory	Core	6	5	100

Objectives:

To understand the fine structure of genetic material, functional modifications and their regulation.
To know the chromosomal basis of genetic disorders, development and differentiation.

Course Outcomes:

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

CO1: Expand knowledge of DNA, RNA structure and understand their synthesis process.
CO2: Summarize transcription and translation concepts.
CO3: Describe transcriptional modification mechanism.
CO4: Interpret various genetic disorders and genetic variation in metabolism.
CO5: Discuss genetic recombination and analyze genetic concepts.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	M
CO5	H	H	H	H	M	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	M
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	M
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Unit 1: **(18 Hours)**

1.1: Molecular structure of DNA – Chemical structure; double helix. (K1, K2, K3, K4, K5)
1.2: Identification of DNA and RNA as genetic material. (K1, K2, K3, K4, K5, K6)
1.3: Characterization of genetic code-non ambiguous- non overlapping; Degenerative code. (K1, K2, K3, K4, K5, K6)
1.4: DNA Replication - Chargaff's rule, geometry, Enzymology of DNA replication. Discontinuous Replication, Events in the Replication Fork, Initiation of Synthesis of the Leading Strand. (K1, K2, K3, K4, K5, K6)

1.5: Bidirectional Replication, Termination of Replication, Methylation of DNA. (K1, K2, K3, K4, K5, K6)
1.6: DNA damage and repair - Excision repair (Base and nucleotide), mismatch repair, recombination repair. (K1, K2, K3, K4, K5, K6)

Unit 2: (18 Hours)

2.1: RNA - Chemical Structure, Types. (K1, K2, K3, K4, K5, K6)
2.2: Transcription**:** Enzymatic Synthesis of RNA; RNA polymerase structure. (K1, K2, K3, K4, K5, K6)
2.3: Basic features of RNA synthesis – Template recognition - Core promoters (-10 and -35 box), UP element; Initiation; Elongation. (K1, K2, K3, K4, K5, K6)
2.4: Termination- Rho independent and Rho dependent. (K1, K2, K3, K4, K5, K6)
2.5: Operons - Prokaryotic transcriptional control: Negative control by repressor and Positive control by CAP (Catabolic Activator Protein). (K1, K2, K3, K4, K5, K6)
2.6: Lac operon; Gal operon. Role of Genome Imprinting in Epigenetic regulation of gene expression. (K1, K2, K3, K4, K5, K6)

Unit 3: (18 Hours)

3.1: Post transcriptional modifications: Splicing - splicing signals. (K1, K2, K3, K4, K5, K6)
3.2: Mechanism of splicing of nuclear mRNA precursor - branched lariat shaped intermediate; snRNPs. (K1, K2, K3, K4, K5, K6)
3.3: Spliceosome - spliceosome assembly and function; alternative splicing. (K1, K2, K3, K4, K5, K6)
3.4: Self-Splicing RNAs- Group I and II Introns - tRNA splicing. (K1, K2, K3, K4, K5, K6)
3.5: Capping: structure; synthesis, function. (K1, K2, K3, K4, K5, K6)
3.6: Polyadenylation: Poly A tailing, mechanism, functions. (K1, K2, K3, K4, K5, K6)

Unit 4: GENETICS (18 Hours)

4.1: Chromosomal mapping in Eukaryotes. (K1, K2, K3, K4, K5, K6)
4.2: Man – Heterokaryon and translocation studies. (K1, K2, K3, K4, K5, K6)
4.3: Inborn errors of metabolism- Protein; Carbohydrate; Lipid; Nucleic acid. (K1, K2, K3, K4, K5, K6)
4.4: Recombination: Types of Recombination, Breakage and Rejoining and Heteroduplexes. (K1, K2, K3, K4, K5, K6)
4.5: Branch migration, The Holliday Model- The recBCD Protein. (K1, K2, K3, K4, K5, K6)
4.6: Evolution of Sex Chromosomes; Dosage compensation and X Inactivation role in Sex Determination. (K1, K2, K3, K4, K5, K6)

Unit 5: (18 Hours)

5.1: Genes in development and differentiation in Drosophila. (K1, K2, K3, K4, K5, K6)
5.2: Binary fate decision, positional pattern formation – A- P axis, D-V axis. (K1, K2, K3, K4, K5, K6)
5.3: Cell fates; refining pattern; comparison of vertebrate/pattern with insects. (K1, K2, K3, K4, K5, K6)
5.4: Neoplasia - Difference between normal and cancer cells- Biochemical, Cytoskeleton, Cell surface. (K1, K2, K3, K4, K5, K6)
5.5: Genetic basis of human cancer; Transforming agents – Oncoviruses (RNA and DNA). (K1, K2, K3, K4, K5, K6)
5.6: Chemical carcinogenesis. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Robert P. Wagner - Introduction to modern genetics- John Wiley and sons, Inc, 1980.
2. Anthony J.F Griffiths - An introduction to genetic analysis 7ed- W.H Freeman, 2000.

Reference Books:

3. Robert F. Weaver - Molecular Biology 5th Edition - McGraw Hill, 2013.
4. Benjamin Lewin - Genes VII- Oxford University Press, 2000.
5. Harvey H. Lodish, Darnell J - Molecular Cell biology- W. H Freeman and Co, 2004.
6. Gardner - Principles of genetics 7ed- John Wiley and Sons Publications, 1984.
7. Nelson D. L, Cox M.M - Lehninger Principles of Biochemistry 4ed- W. H Freeman and Co, 2005.
8. Ursula Goodenough - Genetics 2 Edition- Holt- Saunders International Editions, 1984.
9. Tamarin R.H - Principles of Genetics- WCB Publications,1996
10. Verma P.S, Aggarwal V.K – Genetics- S Chand, 1975.

E-Resources:

https://www.britannica.com

https://www.microscopemaster.com

https://ghr.nlm.nih.gov

https://www.genetics.or

SEMESTER I

PCZOC20- APPLIED BIOTECHNOLOGY AND MICROBIOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I	PCZOC20	Applied Biotechnology And Microbiology	Theory	Core	6	4	100

Objectives:

- To familiarize the use of the data and techniques of engineering and technology in biology for the study of living organisms.
- To make or modify products of processes for specific use.
- To find solution of problems concerning human activities including agriculture, medical treatment, industry and environment
- To acquire a basic knowledge of the microbes in general and of the environmental, medical and industrial important microbes in particular in order to have an integrated approach in biology.

Course Outcomes:

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

CO1: Explain the benefits of microbes in production and value addition of food products.

CO2: Apply the tools and techniques used in molecular biology.

CO3: Solve the problems related to biotechnology keeping in mind the safety factor for environment and society.

CO4: Discuss the basic techniques used in genetic manipulation. Biosafety and ethical issues.

CO5: Explain transgenic animals and their use in research field.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	M	H
CO2	H	H	H	H	M	M
CO3	H	H	H	H	M	M
CO4	H	M	M	H	H	M
CO5	H	H	H	H	M	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	M	M	L
CO4	H	H	H	L	M	H
CO5	H	M	H	H	L	H

Unit 1: **(18 Hours)**

1.1: Microbes in food production- Bread, Yoghurt. (K1, K2, K3, K4, K5)
1.2: Microbes in food production Cheese, Butter. (K1, K2, K3, K4, K5)
1.3: Microbes in food production Vinegar. (K1, K2, K3, K4, K5)
1.4: Microbes in food production Beer and Wine. (K1, K2, K3, K4, K5)
1.5: Food Spoilage. (K1, K2, K3, K4, K5)
1.6: Food Preservation. (K1, K2, K3, K4, K5)

Unit 2: **(18 Hours)**

2.1: Gene therapy. (K1, K2, K3, K4, K5, K6)
2.2: Forensic Medicine-DNA fingerprinting using minisatellite. (K1, K2, K3, K4, K5, K6)
2.3: Autoantibody fingerprinting. (K1, K2, K3, K4, K5, K6)
2.4: Hybridoma technology. (K1, K2, K3, K4, K5, K6)
2.5: Monoclonal antibodies. (K1, K2, K3, K4, K5)
2.6: Polyclonal antibodies. (K1, K2, K3, K4, K5)

Unit 3: **(18 Hours)**

3.1: Use of genetically engineered organisms for removal of specific pollutants. (K1, K2, K3, K4, K5)
3.2: GEM for treating oil spills. (K1, K2, K3, K4, K5)
3.3: GEM for detecting pesticides in the soil and their degradation. (K1, K2, K3, K4, K5)
3.4: Bioleaching, Biomining, Biosurfactants. (K1, K2, K3, K4, K5)
3.5: Biosensors-Conventional, Microbial, Urea. (K1, K2, K3, K4, K5)
3.6: Alcohol and Integrated Multibiosensor. (K1, K2, K3, K4, K5)

Unit 4: **(18 Hours)**

4.1: GM Papaya.GM Tomato. (K1, K2, K3, K4, K5)
4.2: Bt Cotton, Bt Brinjal and Golden Rice. (K1, K2, K3, K4, K5)
4.3: Transgenic plants Application-Industrial enzymes. (K1, K2, K3, K4, K5)
4.4: Organic chemical, plastics. (K1, K2, K3, K4, K5)
4.5: Vaccine- producing plants. (K1, K2, K3, K4, K5)
4.6: Biofertilizers. (K1, K2, K3, K4, K5)

Unit 5: **(18 Hours)**

5.1: Transgenic Fish, Chickens, Mouse. (K1, K2, K3, K4, K5)
5.2: Transgenic Cow, Goat, Sheep. (K1, K2, K3, K4, K5)
5.3: Transgenic Pig, Dog. (K1, K2, K3, K4, K5)
5.4: Applications of Transgenic animals. (K1, K2, K3, K4, K5)
5.5: Molecular Pharming. (K1, K2, K3, K4, K5)
5.6: Gene Pharming in Transgenic animals. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Purohit S.S.2001 - Biotechnology Fundamentals and Applications -Agrobios New Delhi.
2. Dubey R.C. 2014 – Advanced Biotechnology, S.Chand and Company Pvt. Ltd. New Delhi.

Reference Books:

3. Sharma P.D. 2010- Microbiology, Rastogi Publications,Meerut.
4. Gupta P.K.2004 - Biotechnology and Genomics - Rastogi Publications, Meerut.
5. Pelczar M.J., Reid R.D., Chan, E.C.S.1996 – Microbiology - Tata McGraw Hill Co., Ltd., New Delhi.
6. Casida L.E. 1996 –Industrial Microbiology, New Age International (P) Limited, New Delhi.
7. Rema L.P. 2006- Applied Biotechnology, MJP Publishers, Chennai.
8. Moshrafuddin Ahmed and Basumatary S.K. 2008- Applied Microbiology, MJP Publishers, Chennai.
9. Patel A.H. 2007- Industrial Microbiology, Published by Rajiv Beri for Macmillan India Ltd. New Delhi.
10. Kumar H.D. 1998- Modern concepts of Biotechnology, Vikas Publishing House Pvt. Ltd. New Delhi.
11. Vijaya Ramesh K. 2009- Food Microbiology, MJP Publishers, Chennai.
12. Willey, Sherwood and Woolverton 2011 -Joann Prescott's Microbiology, Eighth Edition, McGraw- Hill International Ed. Singapore.
13. Powar C.B. and Daginawala H.F. 2015. General Microbiology- Vol.II Himalaya Publishing House.

E-Resources:

https://www.biointeractive.org
https://www.bio.org
https://www.ncbi.nlm.nih.gov

SEMESTER I

PEZOA20 - ELECTIVE IA: BIOSTATISTICS AND COMPUTATIONAL BIOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I	PEZOA20	Biostatistics and Bioinformatics	Theory	Core	5	5	100

Objective:

- To understand the basic concepts of biostatistics and its application in research.
- To synthesis an area of modern biology in order to analyze and solve biological problems in a more systematic way through computational management.

Course Outcomes:

CO1: Describe statistical population, sampling and probability.

CO2: Explain and perform standard deviation, Student t test and Chi square Test.

CO3: Compute Correlation, Regression and ANOVA.

CO4: Discuss the databases and application of search tools.

CO5: Explain genomics, proteomics, drug designing and phylogenetic tree analysis.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	H	H	L	M
CO2	L	M	H	H	L	M
CO3	L	M	H	H	L	M
CO4	L	M	H	H	L	M
CO5	L	M	H	H	L	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	L	H	M	M
CO2	H	H	H	H	H	M
CO3	H	H	H	H	H	M
CO4	H	H	L	H	L	M
CO5	H	H	L	H	M	M

Unit 1: **(15 Hours)**

1.1: Introduction and scope of statistics. (K1, K2, K3, K4, K5)

1.2: Statistical Population – Finite, Infinite; Sample and Sampling Methods, Variables –Types. (K1, K2, K3, K4, K5)

1.3: Probability – Definition, Events and its types. (K1, K2, K3, K4, K5)

1.4: Types of probability – Apriori, Aposteriori. (K1, K2, K3, K4, K5)

1.5: Rules of probability - Addition rule, Product rule. (K1, K2, K3, K4, K5)

1.6: Simple Choice, Combination, Permutation. (K1, K2, K3, K4, K5)

Unit 2: **(15 Hours)**

2.1: Dispersion – Standard Deviation: Standard Error. (K1, K2, K3, K4, K5)
2.2: Hypothesis testing – Null and Alternate hypothesis. (K1, K2, K3, K4, K5)
2.3: Levels of significance. Degree of freedom. (K1, K2)
2.4: Test of significance for large and small samples. (K1, K2, K3, K4, K5)
2.5: Students 't' Test. (K1, K2, K3, K4, K5)
2.6: Chi square Test. (K1, K2, K3, K4, K5)

Unit 3: **(15 Hours)**

3.1: Correlation – Types. (K1, K2, K3, K4, K5)
3.2: Methods of Correlation-Scatter diagram. (K1, K2, K3, K4, K5)
3.3: Methods of Correlation - Karl Pearson's. (K1, K2, K3, K4, K5)
3.4: Regression – Regression Equation. (K1, K2, K3, K4, K5)
3.5: Regression line. (K1, K2, K3, K4, K5)
3.6: ANOVA – One way analysis (Analysis of Variance). (K1, K2, K3, K4, K5)

Unit 4: BIOINFORMATICS **(15 Hours)**

4.1: Definition – History - Scope of Bioinformatics. (K1, K2, K3, K4, K5)
4.2: Databases - Primary, secondary and Tertiary. (K1, K2, K3, K4, K5)
4.3: Database search - Sequence database search. (K1, K2, K3, K4, K5, K6)
4.4: FASTA. (K1, K2, K3, K4, K5, K6)
4.5: BLAST. (K1, K2, K3, K4, K5, K6)
4.6: Amino acid substitution matrices (PAM) and Blossum. (K1, K2, K3, K4, K5, K6)

Unit 5: **(15 Hours)**

5.1: Genomics. (K1, K2, K3, K4, K5)
5.2: Human Genome Project. (K1, K2, K3, K4, K5)
5.3: Proteomics. (K1, K2, K3, K4, K5)
5.4: Phylogenetic analysis. (K1, K2, K3, K4, K5)
5.5: Drug designing. (K1, K2, K3, K4, K5, K6)
5.6: Drug targeting. (K1, K2, K3, K4, K5, K6)

Books for Study and Reference:

Textbooks:

1. Negi K. S.2012 Methods in Biostatistics AITBS Publication.
2. Gurumani N. 2005 An Introduction to Biostatistics and Revised Edition. MJP Publishers.
3. Sharma V, Munjal A, Shankar A. 2013- A textbook of Bioinformatics- Rastogi Publications.

Reference Books:

4. Visweswara Rao K 1996 –Biostatistics- Jaypee Publication New Delhi.
5. Ronald N, Forthofer, Eun Sul Lee Michael Hernadez 2007 –Biostatistics-An Imprint of Elsevier.
6. Das N G 2009 Statistical Methods-Tata McGraw-Hill Publishing Company-New Delhi.
7. Bernard Rosner – Fundamentals of Biostatistics 5th edition – Duxbury Thomson Learning, USA 2000.
8. Clifford Blair R., Richard A. Taylor – Biostatistics for the Health Sciences – (Indian edition) Dorling Kindersley India Pvt. Ltd., New Delhi 2009.
9. Arthur M.L. 2003 - Introduction to Bioinformatics - Oxford University Press - New Delhi.
10. Attwood T.K, Harry Smith D.J, Phukan S. 2013 – Introduction to Bioinformatics-Published by Dorling Kindersley (India) Pvt. Ltd.
11. Ignacimuthu S.J 2013- Basic Bioinformatics- Narosa Publishing House Pvt. Ltd.
12. Sundaralingam R, Kumaresan V 2013- Bioinformatics- Saras Publications
13. Dan E. Krane, Michael L Raymer 2006- Fundamental concepts of Bioinformatics- Pearson Education Inc.

E-Resources:

https://www.statistics.com
https://bms.ucsf.edu
https://www.iscb.org
http://sbbsindia.in

SEMESTER I

PEZOB20 - ELECTIVE - I B: COMPUTATIONAL METHODS FOR SEQUENCE ANALYSIS

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I	PEZOB20	Computational Methods For Sequence Analysis	Theory	Core	5	5	100

Objective:

- Understand Genomic data acquisition and analysis, comparative and predictive analysis of DNA and protein sequence, Phylogenetic inference etc.

Course Outcomes:

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

CO1: Explain and classify the biological databases and its application.

CO2: Describe the sequence alignment, substitution matrices, and score matrices and search tools.

CO3: Analyze the evolutionary distance and boot strapping strategies.

CO4: Asses the genomic sequences, gene finding and analyses the regulatory regions.

CO5: Explain the secondary structure and gene identification.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Unit 1: **(15 Hours)**

1.1: Introduction to bioinformatics. (K1, K2, K3, K4, K5)

1.2: Classification of biological databases. (K1, K2, K3, K4, K5)

1.3: Biological data formats. (K1, K2, K3, K4, K5)

1.4: Application of bioinformatics in various fields. (K1, K2, K3, K4, K5)

1.5: Introduction to single letter code of amino acids, symbols used in nucleotides.

(K1, K2, K3, K4, K5)

1.6: Data retrieval – Entrez and SRS. (K1, K2, K3, K4, K5, K6)

Unit 2: (15 Hours)

2.1: Introduction to Sequence alignment. (K1, K2, K3, K4, K5)

2.2: Substitution matrices, scoring matrices – PAM and BLOSUM. (K1, K2, K3, K4, K5, K6)

2.3: Local and Global alignment concepts, dot plot, dynamic programming methodology. (K1, K2, K3, K4, K5)

2.4: Multiple sequence alignment – Progressive alignment. (K1, K2, K3, K4, K5)

2.5: Database searches for homologous sequences – FASTA. (K1, K2, K3, K4, K5, K6)

2.6: BLAST versions. (K1, K2, K3, K4, K5, K6)

Unit 3: (15 Hours)

3.1: Evolutionary analysis. (K1, K2, K3, K4, K5)

3.2: Distances - clustering methods. (K1, K2, K3, K4, K5)

3.3: Rooted tree representation. (K1, K2, K3, K4, K5)

3.4: Unrooted tree representation. (K1, K2, K3, K4, K5)

3.5: Bootstrapping strategies. (K1, K2, K3, K4, K5)

3.6: Phylogenetic analysis. (K1, K2, K3, K4, K5)

Unit 4: (15 Hours)

4.1: Fragment assembly. (K1, K2, K3, K4, K5)

4.2: Genome sequence assembly. (K1, K2, K3, K4, K5, K6)

4.3: Gene finding method. (K1, K2, K3, K4, K5)

4.4: Gene prediction – Analysis. (K1, K2, K3, K4, K5)

4.5: Genome annotation. (K1, K2, K3, K4, K5)

4.6: Prediction of regulatory regions. (K1, K2, K3, K4, K5)

Unit 5: (15 Hours)

5.1: Concepts and secondary structure prediction. (K1, K2, K3, K4, K5)

5.2: Probabilistic models. (K1, K2, K3, K4, K5)

5.3: Markov chain. (K1, K2, K3, K4, K5)

5.4: Hidden Markov Models. (K1, K2, K3, K4, K5, K6)

5.5: Gene identification and other applications. (K1, K2, K3, K4, K5, K6)

5.6: Internet resources for gene identification, detection of functional sites, gene expression. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Andreqas D. Baxevanis, B. F. Francis Ouellette. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins John Wiley and Sons, New York (1998).
2. Shanmughavel, P. 2005. Principles of Bioinformatics, Pointer Publishers, Jaipur, India.

Reference Books:

3. Richard Durbin, Sean Eddy, Anders Krogh, and Graeme Mitchison - Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids Cambridge University Press, 1998.
4. Bishop M.J., Rawlings C.J. (Eds.) 1997. DNA and protein sequence analysis. A Practical approach IRL Press, Oxford.
5. Doolittle R.F. (Ed.) Computer methods for macromolecular sequence analysis (Methods in Enzymology, Vol. 266). Academic Press, San Diego (1996).

E-Resources:

https://bms.ucsf.edu
https://www.iscb.org
http://sbbsindia.in

SEMESTER II

PCZOD20 - RESEARCH METHODOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PCZOD20	Research Methodology	Theory	Core	6	4	100

Objectives:

- To enable the students to understand the principles and methods of various instruments used in biology and to prepare them to use these techniques in their own research.
- To understand the Research methods and the preparation of research manuscripts and the role of Journals and e-journals in research.

Course Outcomes:

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

CO1: Describe the principle and working mechanisms of various instruments.

CO2: Interpret theoretical knowledge of various biological instruments useful for research.

CO3: Demonstrate critical thinking in designing research problem and find the solution to scientific research problem.

CO4: Discuss research based acquaintance in designing the experiments and interpretation of data with research tools.

CO5: Explain scientific ideas in both written and oral formats.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	M	H	H	H

Unit 1: **(18 Hours)**

1.1: Principles and biological uses of phase contrast, fluorescence. (K1, K2, K3, K4, K5)

1.2: Scanning and transmission electron microscopes. (K1, K2, K3, K4, K5)

1.3: Spectroscopic techniques- Absorption and Emission principles - UV, visible spectroscopy. (K1, K2, K3, K4, K5)

1.4: Fluorescence and Raman spectroscope. (K1, K2, K3, K4, K5)
1.5: X-ray crystallography. (K1, K2, K3, K4, K5)
1.6: NMR. (K1, K2, K3, K4, K5, K6)

Unit 2: (18 Hours)

2.1: Principle and application of - Chromatography - Gel, Ion, column, Affinity, HPLC & GLC. (K1, K2, K3, K4, K5)
2.2: Electrophoresis – Agarose, SDS - PAGE, Immunoelectrophoresis. (K1, K2, K3, K4, K5)
2.3: Centrifugation - Principle, Ultra centrifugation. (K1, K2, K3, K4, K5)
2.4: Applications of Radioactive Isotopes in biology. (K1, K2, K3, K4, K5, K6)
2.5: Counting methods - GM counters, Scintillation counters. (K1, K2, K3, K4, K5)
2.6: PEG. Autoradiography. (K1, K2, K3, K4, K5)

Unit 3: (18 Hours)

3.1: Scientific Method and its goals. (K1, K2, K3, K4, K5)
3.2: Research process. (K1, K2, K3, K4, K5)
3.3: Criteria of good research – research problem. (K1, K2, K3, K4, K5)
3.4: Criteria for selecting the problem. (K1, K2, K3, K4, K5)
3.5: Necessity of defining the problem – hypothesis. (K1, K2, K3, K4, K5)
3.6: Types of hypothesis - testing of hypothesis and their limitations. (K1, K2, K3, K4, K5)

Unit 4: (18 Hours)

4.1: Research Design - Meaning and needs of research design. (K1, K2, K3, K4, K5)
4.2: Important concepts relating to research design - different research design. (K1, K2, K3, K4, K5)
4.3: Sampling design - Steps in sampling design - Characteristics of good sampling design. (K1, K2, K3, K4, K5)
4.4: Different types of sample design. (K1, K2, K3, K4, K5)
4.5: Research methods – Survey - experimental, exploratory - case study. (K1, K2, K3, K4, K5)
4.6: Selection of tools - criteria for selection of tools – different types of tools - criteria of good research tool. (K1, K2, K3, K4, K5)

Unit 5: (18 Hours)

5.1: Reference work and preparation of dissertation. (K1, K2, K3, K4, K5, K6)
5.2: Pubmed, Google Scholar, and Inflibnet. (K1, K2, K3, K4, K5)
5.3: Computer aided techniques for data analysis, SPSS software. (K1, K2, K3, K4, K5, K6)
5.4: Data presentation and power point presentation. (K1, K2, K3, K4, K5)
5.5: Reference collection – preparation of thesis. (K1, K2, K3, K4, K5)
5.6: Preparation of scientific paper for publication in a Journal. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Anderson Durston, Polle 1970 - Thesis and Assignment Writing - Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford 1979 - Writing Scientific Papers in English - Pitman Medical Publishing Co., London.

Reference Books:

3. Day R.A. 1994 - How to Write and Publish a Scientific Paper - Cambridge University Press, London.
4. Palanichamy S. and Shanmugavelu M. 1997 - Research Methods in Biological Sciences – Palani Paramount Publications, Tamil Nadu, India.
5. Milton J.S.,1992-Statistical Methods in Biological and Health Sciences-McGrawHill Inc., York.
6. Gurumani N. 2006 - Research Methodology for Biological Sciences - MJP Publishers, Chennai.
7. Kothari C.R. 2010- Research Methodology- New Age International Publishers.
8. Sybesma C., 1989, Biophysics-An Introduction, Kluwer Academic Publisher.
9. Thomas F. Weiss, 1995, Cellular Biophysics I and II, MIT press.
10. Yeargers E.K, 1992, Basic Biophysics for Biology, CRC press.
11. Narayanan P. 2000- Essentials of Biophysics- New Age International Publishers.

E-Resources:

https://research-methodology.net
https://study.com/academy
https://ncu.libguides.com

SEMESTER II

PCZOE20 - APPLIED ENTOMOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PCZOE20	Applied Entomology	Theory	Core	5	4	100

Objective:

- This core paper has been designed to understand the biology of Insects, Insect pest management, Integrated Pest Management and biological control.

Course Outcomes:

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

CO1: Identify the pest in different cash crops and the mode of infection.

CO2: Analyze the pest species of vegetables, fruits, stored grains and household pests.

CO3: Categorize the different insect pests and vectors of livestock.

CO4: Explain the classification of insecticides and the mode of action.

CO5: Apply appropriate method of insect pest management and integrated pest management.

CO/PO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	M	H
CO2	H	H	M	H	M	H
CO3	H	H	M	H	M	H
CO4	H	M	M	H	M	H
CO5	H	H	M	H	M	H

Unit 1: **(15 Hours)**

1.1: Causes for insects assuming pest status. (K1, K2, K3, K4, K5)

1.2: Forecasting Pest outbreak. (K1, K2, K3, K4, K5)

1.3: Biology, nature, extent of damage and control measures of insect pests of Sugarcane - *Chilo infuscatellus, Tryporyza nivella, Chilo sacchariphagus*. (K1, K2, K3, K4, K5)

1.4: Biology, nature, extent of damage and control measures of insect pests of Cotton – *Aphis gossypii, Dysdercus koenigii, Thrips tabaci.* (K1, K2, K3, K4, K5)

1.5: Biology, nature, extent of damage and control measures of insect pests of Groundnut – *Aphis craccivora, Aproraema modicella, Helicoverpa armigera.* (K1, K2, K3, K4, K5)

1.6: Coconut - *Rhyncophorus ferrugineus, Oryctes rhinoceros, Nephantis seiropa.* (K1, K2, K3, K4, K5)

Unit 2: (15 Hours)

2.1: Biology, nature, extent of damage and control measures of insect pests of Vegetable - *Epilachna dodecastigma, Pieris brassicae, Leucinodes orbonalis.* (K1, K2, K3, K4, K5)

2.2: Biology, nature, extent of damage and control measures of insect pests of Fruits - *Sternochetus mangifera, Cosmopolites sordidus, Papilio demoleus.* (K1, K2, K3, K4, K5)

2.3: Biology, nature, extent of damage and control measures of insect pests of Stored product - Paddy - *Leptocorisa varicornis, Tryporyza incertulus, Sitophilus oryzae*. (K1, K2, K3, K4, K5)

2.4: Biology, nature, extent of damage and control measures of insect pests of stored product Wheat - *Triticum vulgare, Mythimna separata, Spodoptera mauritia.* (K1, K2, K3, K4, K5)

2.5: Biology, nature, extent of damage and control measures of insect pests of Household pest- *Ctenolepisma saccharina, Anthrena pimpinella, Trichophaga abruptella.* (K1, K2, K3, K4, K5)

2.6: Insect resistant crops. (K1, K2, K3, K4, K5, K6)

Unit 3: (15 Hours)

3.1: Insect pest of domestic animals - Cattle- Cattle fly. (K1, K2, K3, K4, K5)

3.2: Insect pest of domestic animals Ox - Warble fly. (K1, K2, K3, K4, K5)

3.3: Insect pest of domestic animals Fowl - Chicken flea, Shaft louse. (K1, K2, K3, K4, K5)

3.4: Insect pest of domestic animals Sheep and Goat - Head Maggot, Sheep Ked, Biting Louse. (K1, K2, K3, K4, K5)

3.5: Insect vectors of Animals – Mites, Ticks. (K1, K2, K3, K4, K5)

3.6: Organic methods of domestic pest management. (K1, K2, K3, K4, K5)

Unit 4: (15 Hours)

4.1: Classification of Insecticides - Chemical nature – Inorganic - Arsenic and Fluorine compounds. (K1, K2, K3, K4, K5)

4.2: Organic compounds- Animal origin – Nereistoxin. (K1, K2, K3, K4, K5)

4.3: Plant origin - Nicotinoids, Pyrethroides, Rotenoids. Hydrocarbons. (K1, K2, K3, K4, K5)

4.4: Synthetic organic compounds - DDT, BHC, Parathion. (K1, K2, K3, K4, K5)

4.5: Mode of action - Physical Poison, Protoplasmic Poison, Respiratory Poison. (K1, K2, K3, K4, K5)

4.6: Nerve Poison. Mode of Entry - Stomach Poisons, Contact Poison, Fumigants. (K1, K2, K3, K4, K5)

Unit 5: (15 Hours)

5.1: Biological control of plant pest. (K1, K2, K3, K4, K5)

5.2: Viral insecticides, Bacterial insecticides, Fungal insecticides. (K1, K2, K3, K4, K5)

5.3: Integrated Pest Management. (K1, K2, K3, K4, K5, K6)

5.4: Use of insect pathogens in control of pest. (K1, K2, K3, K4, K5)

5.5: Non-conventional pest control- Insect Attractants, Repellents, Antifeedants, Genetic radiations. (K1, K2, K3, K4, K5)

5.6: Plant protection appliances- Duster, Sprayers and Fumigators. (K1, K2, K3, K4, K5)

Books for study and Reference:

Textboks:

1. Vasantharaj V.B, Kumaraswami. T- 1998-Elements of Economic Entomology- Popular Book Depot.
2. Nalina Sundari, Santhi R- 1962- Entomology- MJP Publishers.

Reference Books:

3. Jawaid Ahsan, Subhas Prasad Sinha 1981- A handbook on Economic Zoology- S. Chand and Company limited.
4. B.S Tomar 2004-Introduction to Economic Zoology-EMKAY Publications.
5. Chinmoy Goswami, B.D Panaik 2011- Handbook of Entomology- Wisdom press.
6. M. R Ghosh 1995-Concepts of Insect control- New Age International Publishers.
7. C.L Metcalf, W.P Flint 1962- Destructive and useful insects their habits and control 4ed- Tata McGraw Hill Publications.
8. United Stated Department of Agriculture Washington DC 1952- The Yearbook of Agriculture – Oxford and IBH Publishing Co.
9. David B.V, Muralirangan, M.C, Meera Muralirangan 1992- Harmful and Beneficial Insects- Popular Book Depot.
10. Saxena A.B 1996 - Harmful Insects- Anmol Publications.

E-Resources:

http://www.entosocindia.org
https://www.entsoc.org
https://entomology.cals.cornell.edu

SEMESTER II

PCZOF20 - BIODIVERSITY AND WILDLIFE CONSERVATION

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PCZOF20	Biodiversity and wild life conservation	Theory	Core	6	4	100

Objective:

- To understand the habitat and distribution of wild animals, causes for their endangerment and methods adopted for their conservation.

Course Outcomes:

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

CO1: Discuss the Biodiversity India and ecosystems.

CO2: Explain the values of Biodiversity.

CO3: Discuss the Wildlife of India and threats to the wildlife.

CO4: Explain Wildlife protection and conservation.

CO5: Explain conservation methods.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	H	H	H	M	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	M	H
CO2	H	H	M	H	M	H
CO3	H	H	M	H	M	H
CO4	H	M	M	H	M	H
CO5	H	H	M	H	M	H

Unit 1: **(18 Hours)**

1.1: Biodiversity in India: Genetic, species and ecosystem diversity. (K1, K2, K3, K4, K5)

1.2: Biogeographic classification of India. National and local level. (K1, K2, K3, K4, K5)

1.3: India as a mega diversity nation. (K1, K2, K3, K4, K5, K6)

1.4: Ecology and Ecosystems - Structure and function of ecosystem. (K1, K2, K3, K4, K5)

1.5: Energy flow in the ecosystem. (K1, K2, K3, K4, K5, K6)

1.6: Types of Ecosystem: Forest, Aquatic (Lake and Ocean) and Urban. (K1, K2, K3, K4, K5)

Unit 2: **(18 Hours)**

2.1: Value of biodiversity: Consumptive use, Productive use, Social, Ethical and Aesthetic. (K1, K2, K3, K4, K5)
2.2: Hotspots of biodiversity. (K1, K2, K3, K4, K5, K6)
2.3: Endemic and Invasive species. (K1, K2, K3, K4, K5)
2.4: Threats to biodiversity: Habitat loss. (K1, K2, K3, K4, K5, K6)
2.5: Climate change; Poaching. (K1, K2, K3, K4, K5)
2.6: Man and wildlife conflicts. (K1, K2, K3, K4, K5)

Unit 3: **(18 Hours)**

3.1: Wildlife of India. (K1, K2, K3, K4, K5)
3.2: Values of wildlife - Positive and Negative. (K1, K2, K3, K4, K5)
3.3: Morphological and Physiological adaptations of Endangered and threatened species. (K1, K2, K3, K4, K5)
3.4: Population dynamics: Exponential and Logistic. (K1, K2, K3, K4, K5)
3.5: Local and Regional Extinction. (K1, K2, K3, K4, K5)
3.6: Red Data Book. (K1, K2, K3, K4, K5)

Unit 4: **(18 Hours)**

4.1: Wildlife protection Act. (K1, K2, K3, K4, K5)
4.2: In-situ and ex-situ conservation. (K1, K2, K3, K4, K5, K6)
4.3: IUCN Red List – CITES. (K1, K2, K3, K4, K5)
4.4: National Parks and Sanctuaries. (K1, K2, K3, K4, K5)
4.5: Biospheres reserves. (K1, K2, K3, K4, K5)
4.6: Project Tiger - Project Gir Lion and Crocodile breeding project. (K1, K2, K3, K4, K5)

Unit 5: **(18 Hours)**

5.1: Germplasm conservation and Cryogenic preservation. (K1, K2, K3, K4, K5)
5.2: Assisted reproduction. (K1, K2, K3, K4, K5)
5.3: Captive breeding - Non-invasive and Minimal invasive method. (K1, K2, K3, K4, K5)
5.4: Scat analysis and Radio telemetry. (K1, K2, K3, K4, K5, K6)
5.5: Habitat suitability. (K1, K2, K3, K4, K5)
5.6: Remote sensing and GIS. (K1, K2, K3, K4, K5, K6)

Books for Study and Reference:

Textbooks:

1. H.R Singh, Neeraj Kumar - Ecology and Environmental science- Vishal Publishing Co., 2006
2. Rayappa A. Kasi - Earth- Designed for Biodiversity- LTD Media Publications, 2010

Reference Books:

3. K.C Agarwal - Biodiversity- Agarobios India, 2000
4. Desh Deepak Verma, Sujata Arora, R K Rai - Perspectives of Biodiversity-Ministry of Environment and Forest, 2006
5. Lee Hannah - Climate change Biology- Elsevier, 2011
6. P.C Das - Environmental Biology- AITBS Publishers India, 2011
7. V.K Agarwal, Usha Gupta - Ecology and Ethology- S. Chand and Company Ltd, 2002

E-Resources:

http://www.enviroindia.net

http://aelsindia.com

http://environment-ecology.com

SEMESTER II

PCZOG20 - PRACTICAL I

INVERTEBRATA, CHORDATA, MOLECULAR BIOLOGY, GENETICS, BIOTECHNOLOGY AND MICROBIOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I & II	PCZOG20	Practical -I	Practical	Core	3	4	100

Course Outcomes:

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

CO1: Demonstrate and dissect different systems of specimen.

CO2: Identify structural modification of chordates, adaptive feature based on mode of life and chromosomes.

CO3: Identify and explain various inborn errors of metabolism, describe karyotyping and identify functional gene in given sequence.

CO4: Gain practical insights on various instruments used in molecular biology.

CO5: Identify /explain various microorganisms, transgenic animals and GM plants.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	H	H	H	M	H

CO/PSO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	M	H
CO2	H	H	M	H	M	H
CO3	H	H	M	H	M	H
CO4	H	M	M	H	M	H
CO5	H	H	M	H	M	H

Major: Dissections:

1. Invertebrata: Digestive system- Prawn, Cockroach and Sepia
Nervous system – Prawn, Cockroach and sepia

2. Chordata: 9^{th} and 10^{th} Cranial nerves of Shark
Arterial system of Shark

3. Minor: Mounting:

Appendages of Prawn
Mouth parts – Cockroach, Mosquito, House fly, Honey bee
Sting of Honey Bee
Brain of frog and calotes (Museum Specimen)

4. Study of museum specimen and slides relevant to

- Structural modifications of chordates - Hippocampus, Acipenser and Ambystoma.
- Adaptive features for their mode of life - Echeneis, Hyla, and Draco.

5. Molecular Biology and Genetics:

a. Giant chromosome - polytene chromosomes 1. Chironomous Larva (Slide),
2. Lampbrush chromosomes - chart

b. Identification of a functional gene in the given nucleotide sequence.

6. Karyotyping using human metaphase chromosome plates: Identification of syndromes:

(i) Down (ii) Klinefelter (iii) Turner

7. Study on Inborn errors of metabolism using Chromosomal Charts.

Lipid metabolism	-	Tay-Sachs and Niemann-Pick
Protein metabolism	-	PKU and Alkaptonuria
Carbohydrate metabolism	-	Galactosemia and Pompe's disease

8. Visit to a Molecular Biology laboratory.

9. Biotechnology and Microbiology:

a) Aspergillus, Rhizopus, Pseudomonas,Bacillus
b) *Salmonella, Lactobacillus, Saccharomyces cerevisiae*
c) GM Papaya, GM Tomato, Bt Cotton, Bt Brinjal
d) Hybridoma Technology
e) Transgenic Animals- Fish, Goat.

10. Determination of Bacterial Growth by Turbidity Measurement – Demonstration.

SEMESTER II

PCZOH20 - PRACTICAL II - RESEARCH METHODOLOGY, APPLIED ENTOMOLOGY, BIODIVERSITY AND WILDLIFE CONSERVATION

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I &II	PCZOH20	Practical II	Practical	Core	3	4	100

Course Outcomes:

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

CLO1: Apply basic concepts of instrumentation.

CLO2: Gain skills in techniques of chromatography, electrophoresis and spectroscopy.

CLO3: Demonstrate Histochemical staining techniques.

CLO4: Summarize the insect pest and their control measures.

CLO5: Explain biodiversity and explore the fauna existing around for documentation and motivates for further studies and research in the field.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	L	H	M	H
CO4	H	M	M	H	M	H
CO5	H	H	H	H	M	H

LOW-L, MEDIUM-M, HIGH- H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	L	M
CO2	H	H	H	L	M	H
CO3	H	H	H	M	M	L
CO4	H	H	H	H	M	H
CO5	H	M	H	H	L	H

Research Methodology:

1. Electrophoresis – Agarose gel - SDS PAGE
2. Paper Chromatography
3. Gel/ Affinity Chromatography- Demonstration
4. Histochemical staining technique of Carbohydrates, Protein and Lipids
5. Estimation of Urea - DAM Method
6. Estimation of Cholesterol - ZAC'S Method
7. Estimation of Glucose – Ortho Toluidine Method
8. Estimation of Protein – Biuret Method

Spotters: Microscope- Compound, Fluorescent, TEM, SEM

Applied Entomology:

Study on Insect Pests:- Spotters

1. Pest of sugarcane – *Euetheola humilis, Chilio infuscatellus*

2. Pest of cotton – *Dysdercus koenigii, Aphis gossypii*
3. Pest of paddy – *Sogatella furcifera, Leptocorisa varicornis*
4. Pest of coconut- *Oryctes rhinoceros, Rhyncophorus ferrugineus*
5. Pest of Wheat- *Meromyza Americana, Triticum vulgare*
6. Pest of Fruits- *Batocera rufamaculata, Papilio demoleus*
7. Pest of vegetables- *Epilachna vigintioctopunctata, Leucinodes orbonalis*
8. House hold pest- *Ctenolepisma saccharina, Anthrena pimpinella*
9. Stored products pest- *Sitophilus oryzae, Leptocorisa varicornis*
10. Collection of Insects and preservation Techniques- Insect box

Biodiversity and Wild Life Conservation:

1. Observation and documentation of fauna inside the College campus – Soil microarthropods- Annelids, Amphibians, Reptiles and Birds
2. Spotters of endemic species- Laughing thrush, Grey headed bulbul.
3. Endangered species of India- Red crowned roofed turtle, Javan rhinoceros.
4. Zoo geographical realms:
   -Holartic realm-Hoary bat, Elk
   -Paleotropical realm- Hyena, Gibbon
   -Notogaean realm- Flying fox, Bandicoot
   -Antartic realm – Leopard seal, Orca
5. Hotspots of Tamil Nadu- Western Ghats- Lion tailed macaque, Dwarf Malabar Pufferfish, Nilgiri Langur.
6. Endemism- Komodo dragon, Kangaroo, Kiwi

SEMESTER II

PEZOC20 - ELECTIVE II A: BIOCHEMISTRY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PEZOC20	Biochemistry	Theory	Elective	5	5	100

Objective:

- To comprehend the molecular design of life introduces the most important classes of biological macromolecules like proteins, carbohydrates, lipids and presents the basic concepts of catalysis and enzyme action.

Course Outcomes:

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

CO1: Explain the atom and types of bonds and buffers.

CO2: Explain the properties of water body fluids its biological function and Classification of Amino acids.

CO3: Appraise the classification, properties and mode of action of Protein and Enzyme.

CO4: Summarize the complexity of the carbohydrate metabolism.

CO5: Categorize the Vitamins and its importance.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	L	H
CO2	H	H	L	H	L	M
CO3	H	H	L	H	L	H
CO4	H	M	L	H	M	H
CO5	H	H	L	M	L	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	L	M
CO2	H	M	H	L	M	M
CO3	H	L	H	M	M	L
CO4	H	H	H	H	M	H
CO5	H	M	H	H	L	H

Unit 1: **(15 Hours)**

1.1: Structure of an atom. Types of bonds-covalent-ionic- hydrogen. (K1, K2, K3, K4, K5)

1.2: Zwitter ions- isoelectrical point. (K1, K2, K3, K4, K5)

1.3: Water - Biological importance, Physical properties, Structure, Interactions in aqueous solution. (K1, K2, K3, K4, K5)

1.4: pH and buffers. (K1, K2, K3, K4, K5)

1.5: Acid- Base balance, Henderson Hasselbach equation, Biological importance of Buffers. (K1,K2, K3, K4, K5)
1.6: Acidosis and Alkalosis. (K1, K2, K3, K4, K5)

Unit 2: **(15 Hours)**

2.1: Electrolyte and water balance. (K1, K2, K3, K4, K5)
2.2: Body fluids- Milk, Colostrum. (K1, K2, K3, K4, K5)
2.3: Amniotic fluid and CSF. (K1, K2, K3, K4, K5)
2.4: Urine. (K1, K2, K3, K4, K5)
2.5: Amino Acids: Structure. (K1, K2, K3, K4, K5)
2.6: Classification of amino acids and properties. (K1, K2, K3, K4, K5)

Unit 3: **(15 Hours)**

3.1: Proteins**:** Classification of Proteins based on the structure, properties. (K1, K2, K3, K4, K5)
3.2: Metabolism- Deamination, Transamination, Transmethylation. (K1, K2, K3, K4, K5)
3.3: Kreb's Henslict cycle(Urea cycle). (K1, K2, K3, K4, K5)
3.4: Enzymes**:** Nomenclature, Classification. (K1, K2, K3, K4, K5)
3.5: Properties of enzymes. (K1, K2, K3, K4, K5)
3.6: Mode of enzyme action, enzyme substrate compounds. (K1, K2, K3, K4, K5)

Unit 4: **(15 Hours)**

4.1: Carbohydrates**:** Structure. Classification. (K1, K2, K3, K4, K5)
4.2: Metabolism- Glycogenesis, Glycogenolysis, Gluconeogenesis. Glycolysis- Embden Meyerhoff Pathway. Hexose Monophosphate shunt. (K1, K2, K3, K4, K5, K6)
4.3: Lipids**:** Structure and Classification. (K1, K2, K3, K4, K5)
4.4: Biosynthesis and oxidation of fatty acids-Biological significance of carbohydrates, protein and lipids. (K1, K2, K3, K4, K5)
4.5: Convergence of Central Metabolic Pathway - TCA/Kreb's Cycle. (K1, K2, K3, K4, K5, K6)
4.6: Electron transport system. (K1, K2, K3, K4, K5)

Unit 5: **(15 Hrs)**

5.1: Water soluble Vitamins - Structure, Classification, Sources, Functions. (K1, K2, K3, K4, K5)
5.2: Hyper and Hypo vitaminosis and deficiencies in man. (K1, K2, K3, K4, K5)
5.3: Fat soluble Vitamins - Structure, Classification, Sources, Functions. (K1, K2, K3, K4, K5)
5.4: Hyper and Hypo vitaminosis and deficiencies in man. (K1, K2, K3, K4, K5)
5.5: Metabolism of Xenobiotics. (K1, K2, K3, K4, K5)
5.6: Detoxification and Biotransformation. (K1, K2, K3, K4, K5, K6)

Books for Study and Reference:

Textbooks;

1. Rastogi S. C 2013 – Biochemistry 2ed- Tata McGraw Hill Publishing Company Ltd., N. Delhi.
2. Jain J.L. 2001- Fundamentals of Biochemistry - S. Chand and Company.

Reference Books:

1. Lehninger A.L. 1984- Principles of Biochemistry - CBS Publishers and Distributors, New Delhi.
2. Friefelder D. 1993- Physical Biochemistry -W.H. Freeman & Company.
3. Peter R. Bergethon, 1998- The Physical Basis of Biochemistry - Springer-Verlag
4. Lubert stryer 1989 - Biochemistry - Freeman International Edition
5. Keshav Trehan 1997 - Biochemistry- Wiley Eastern Publications.
6. Roger L.P. Adams, John T. Knowler and David P. Leader 1998 - The Biochemistry of Nucleic acid 10ed - Chapman and Hall Publications.

E-Resources:

https://www.oercommons.org
https://www.oercommons.org
https://www.mcgill.ca

SEMESTER II

PEZOD20 - ELECTIVE II B: ENDOCRINOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PEZOD20	Endocrinology	Theory	Elective	5	5	100

Objective:

- To make the students learn the objectives and scope of comparative endocrinology, anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions

Course Outcomes:

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

CO1: Discuss hormones its classification and function, the anatomy of endocrine glands,

CO2: Explain Pituitary and Parathyroid Structure and Function.

CO3: Comprehensive knowledge about structure and function of Pancreas and Adrenal glands.

CO4: Describe the complexity of the endocrine system of invertebrates.

CLO5: Elucidate hormones in development.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	M	H	H
CO5	H	H	H	H	H	H

Unit 1: **(15 Hours)**

1.1: Introduction, objectives and scope of endocrinology. (K1, K2, K3, K4, K5)

1.2: Modern concepts in Endocrinology. (K1, K2, K3, K4, K5)

1.3: Problems in Endocrinology. (K1, K2, K3, K4, K5)

1.4: Endocrine glands in crustaceans, insects and vertebrates. (K1, K2, K3, K4, K5, K6)

1.5: Experimental methods of hormone research. (K1, K2, K3, K4, K5, K6)

1.6: General classes of chemical messengers. (K1, K2, K3, K4, K5)

Unit 2: **(15 Hours)**

2.1: Pituitary gland - characteristics, structural organization. (K1, K2, K3, K4, K5)
2.2: Hormone secretion and its functions. (K1, K2, K3, K4, K5)
2.3: Hypothalamic control. (K1, K2, K3, K4, K5)
2.4: Thyroid gland - structural organizations. (K1, K2, K3, K4, K5)
2.5: Metabolic effects of thyroid - effects on reproduction. (K1, K2, K3, K4, K5)
2.6: Parathyroid its structures and functions. (K1, K2, K3, K4, K5)

Unit 3: **(15 Hours)**

3.1: Structure of pancreas. (K1, K2, K3, K4, K5)
3.2: Pancreatic hormones and their functions. (K1, K2, K3, K4, K5)
3.3: Structural organizations of adrenals. (K1, K2, K3, K4, K5)
3.4: Hormones secreted by adrenal gland. (K1, K2, K3, K4, K5)
3.5: Functions of cortical hormones. (K1, K2, K3, K4, K5)
3.6: Functions of Medullary hormones. (K1, K2, K3, K4, K5)

Unit 4: **(15 Hours)**

4.1: Concepts of neurosecretions. (K1, K2, K3, K4, K5, K6)
4.2: Endocrine systems in crustaceans. (K1, K2, K3, K4, K5)
4.3: Endocrine control of moulting and metamorphosis. (K1, K2, K3, K4, K5)
4.4: Neuroendocrine system in insects. (K1, K2, K3, K4, K5)
4.5: Endocrine control of moulting in insects. (K1, K2, K3, K4, K5)
4.6: Metamorphosis and reproduction in insects. (K1, K2, K3, K4, K5)

Unit 5: **(15 Hours)**

5.1: Hormonal control of metamorphosis in an anuran amphibian. (K1, K2, K3, K4, K5)
5.2: Structure and hormones of mammalian testis. (K1, K2, K3, K4, K5)
5.3: Structure and hormones of mammalian ovary. (K1, K2, K3, K4, K5)
5.4: Estrous and menstrual cycle. (K1, K2, K3, K4, K5)
5.5: Hormones of pregnancy and parturition. (K1, K2, K3, K4, K5)
5.6: Hormonal control of lactation. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Harris G.W and B.T. Donovan 1968- The Pituitary Gland-S. Chand and Co.
2. Bentley P.J 1985 – Comparative Vertebrate Endocrinology 2ed- Cambridge University Press, Cambridge.

Reference Books:

3. Mac Hadley 1992 - Endocrinology 3ed- Prentice Hall Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey, USA.
4. Turner, C.D. and J.T. Bangara 1986 - General Endocrinology- Saunders International Student Edition, Toppan Company Limited, Tokyo.
5. Ingleton P.M. and J.T. Bangara 1986 - Fundamentals Comparative Vertebrate Endocrinology, Kluwer Academic Publishers.
6. Barrington E.J.W. 1985 - An introduction to General and Comparative Endocrinology Claredon Press Oxford.

E-Resources:

https://www.endocrinology.org
https://www.hormone.org
https://www.endotext.org

SEMESTER III

PCZOI20 - ENVIRONMENTAL BIOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PCZOI20	Environmental Biology	Theory	Core	7	4	100

Objectives:

- Understand the Changes in environment and its impact.
- Understand the contaminants, their effects and disposal.
- Importance of recycling technologies in Environmental Conservation.
- Understand the issues related to pollution and laws enforced.

Course Outcomes:

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

CO1: Describe ecological succession and Environmental stresses and their management.

CO2: Explain the major classes of contaminants and their impact on environment.

CO3: Explain green energy and the types of recycling technologies for solid and liquid wastes and their role in environmental conservation.

CO4: Discuss environmental indicators and their role in environmental balances and bioremediation.

CO5: Explain the importance of global ecology towards sustainable civilization.

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	H	H	H	H	M	H
CLO2	H	H	H	H	M	H
CLO3	H	H	H	H	M	H
CLO4	H	H	H	H	M	H
CLO5	H	H	H	H	M	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	H	H	M	H	M	H
CLO2	H	H	M	H	M	H
CLO3	H	H	M	H	M	H
CLO4	H	H	M	H	M	H
CLO5	H	H	M	H	M	H

Unit 1: **(21 Hours)**

1.1: Ecological succession – Process and Patterns of Succession. (K1, K2, K3, K4, K5)

1.2: Human influence on Succession. (K1, K2, K3, K4, K5, K6)

1.3: Homeostasis. (K1, K2, K3, K4, K5, K6)

1.4: Radioactive compounds and their impact on the environment. (K1, K2, K3, K4, K5)

1.5: Environmental Stresses and their management - global climatic pattern. (K1, K2, K3, K4, K5, K6)
1.6: Atmospheric ozone, Ozone depletion, coping with climatic variations. (K1, K2, K3, K4, K5, K6)

Unit 2: **(21 Hours)**

2.1: Major classes of contaminants. (K1, K2, K3, K4, K5)
2.2: Uptake, biotransformation, detoxification, elimination and accumulation of toxicants. (K1, K2, K3, K4, K5)
2.3: Factors influencing bioaccumulation from food and tropic transfer. (K1, K2, K3, K4, K5)
2.4: Important heavy metals and their role in environment. (K1, K2, K3, K4, K5)
2.5: Agrochemical use and misuse, alternatives. Pesticides and other chemicals in agriculture, industry and hygiene and their disposal. (K1, K2, K3, K4, K5)
2.6: Impact of chemicals on biodiversity of microbes, animals and plants. Biodegradation of chemicals. (K1, K2, K3, K4, K5)

Unit 3: **(21 Hours)**

3.1: Green energy – Bio fuels. (K1, K2, K3, K4, K5)
3.2: Recycling and reuse technologies for solid wastes and their role in environmental conservation. (K1, K2, K3, K4, K5)
3.3: Recycling and reuse technologies for liquid wastes and their role in environmental conservation. (K1, K2, K3, K4, K5)
3.4: Remote sensing – basic concepts. (K1, K2, K3, K4, K5)
3.5: Applications of remote sensing techniques in environmental conservation. (K1, K2, K3, K4, K5, K6)

Unit 4: **(21 Hours)**

4.1: Environmental indicators and their role in environmental balance. (K1, K2, K3, K4, K5)
4.2: Bioremediation - Definition - Need and Scope of Bioremediation. (K1, K2, K3, K4, K5, K6)
4.3: Environmental application of Bioremediation. (K1, K2, K3, K4, K5)
4.4: Phytoremediation. (K1, K2, K3, K4, K5)
4.5: Biomagnifications. (K1, K2, K3, K4, K5)
4.6: Bioavailability. (K1, K2, K3, K4, K5)

Unit 5: **(21 Hours)**

5.1: Global ecology towards sustainable civilization: Ecological. (K1, K2, K3, K4, K5)
5.2: Societal gaps. (K1, K2, K3, K4, K5)
5.3: Global sustainability, Long term transitions. (K1, K2, K3, K4, K5)
5.4: Human designed and Management systems. (K1, K2, K3, K4, K5)
5.5: Environmental laws and Acts pertaining to environmental protection and management. (K1, K2, K3, K4, K5)
5.6: Environmental monitoring and environmental assessment. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Text books:

1. Odum E.P., 1983, Basic Ecology, Saunders, New York.
2. Shardha Sinha, Manisha Shukla and Ranjana Shukla. 2013, A Text book of Environmental Studies, A.I.T.B.S. Publishers, India.

Reference Books:

3. Rao C.S., 1992, Environmental Pollution Control Engineering, Wiley Eastern Ltd.
4. Peter Gomes Dayal, 2010-11, Environmental Toxicology, Dominant Publishers.
5. Trivedi P.R., Gurdeep Raj, 1992, Environmental Biology, Akashdeep Publishing House.
6. Sharma B.K., 2001, An Introduction to Environmental Pollution, Goel Publishing House, Meerut.
7. Sharma P.D., 1995, Ecology and Environment, Rastogi Publications.
8. Chapman J.L. and Resiss M.J., 1992, Ecology Principles and applications, Cambridge University Press.
9. Biswarup Mukherjee, 1997, Environmental Biology, Tata McGraw-Hill Publishing Company Ltd. New Delhi.
10. Lee Hannah 2011, Climate Change Biology, Elsevier.
11. Conklin, A.R. Jr., 2004, Principles and Practices in Environmental Analysis, CRC Press.
12. Grant, W.E. and Swannack, T.M., 2013, Ecological Modeling, Blackwell.
13. Meenambal T., Uma R.N., and Murali K.,2005, Principles of Environmental Science and Engineering, S. Chand and Company Ltd.

E-resources:

https://www.sebiology.org
http://www.enviroindia.net
http://aelsindia.com
http://environment-ecology.com

SEMESTER III

PCZOJ20 - LIMNOLOGY AND TOXICOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PCZOJ20	Limnology and Toxicology	Theory	Core	6	4	100

Objectives:

- To understand the different fresh water habitat, their fauna and Physio-chemical properties.
- An introduction to basic toxicology to understand dosage, route of exposure and its effects on fauna

Course Outcomes:

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

CO1: Attains basic concept about fresh water habitats and its types.

CO2: Describe the Physio-Chemical Characteristics and its importance in freshwater ecosystems.

CO3: Summarize about the organisms and adaptation in the freshwater ecosystem.

CO4: Explain the basic knowledge about toxicology its principle, agents and estimation methods.

CO5: Describe the impact of toxicant in the aquatic ecosystem.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	L
CO2	H	H	H	H	M	M
CO3	H	H	H	H	M	M
CO4	H	H	H	H	M	M
CO5	H	H	H	H	M	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	L	H
CO2	H	H	M	H	M	H
CO3	H	H	H	M	M	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Unit 1: LIMNOLOGY **(18 Hours)**

1.1: Limnology – Definition, historical development. (K1, K2, K3, K4, K5)

1.2: Scope of Limnology. (K1, K2, K3, K4, K5)

1.3: Types of freshwater habitats and their ecosystem. (K1, K2, K3, K4, K5, K6)

1.4: Lentic- Ponds. (K1, K2, K3, K4, K5)

1.5: Lakes. (K1, K2, K3, K4, K5)

1.6: Lotic- Streams, Rivers. (K1, K2, K3, K4, K5)

Unit 2: **(18 Hours)**

2.1: Physio – Chemical Characteristics- Light. (K1, K2, K3, K4, K5)
2.2: Temperature and Radiation.(K1, K2, K3, K4, K5)
2.3: Stratification and Heat Budget. (K1, K2, K3, K4, K5)
2.4: Dissolved Solids – Carbonate, Bicarbonates, Phosphate and Nitrate. (K1, K2, K3, K4, K5)
2.5: Turbidity. (K1, K2, K3, K4, K5)
2.6: Dissolved gases - Oxygen, Carbon dioxide, pH. (K1, K2, K3, K4, K5)

Unit 3: **(18 Hours)**

3.1: General study of freshwater organisms. Plankton – Phytoplankton - Diatoms, Dinoflagellates, Blue- green algae. (K1, K2, K3, K4, K5, K6)
3.2: Zooplankton – Larval forms of Arthropods. (K1, K2, K3, K4, K5, K6)
3.3: Benthos- general adaptations. (K1, K2, K3, K4, K5)
3.4: Littoral zone- general adaptations. (K1, K2, K3, K4, K5)
3.5: Limnetic zone- general adaptations. (K1, K2, K3, K4, K5)
3.6: Profundal zone - general adaptations. (K1, K2, K3, K4, K5)

Unit 4: TOXICOLOGY **(18 Hours)**

4.1: Toxicology - Basic concepts. (K1, K2, K3, K4, K5)
4.2: Toxicokinetics –Principles- ADME (Absorption, Distribution, Metabolism and Excretion). (K1, K2, K3, K4, K5, K6)
4.3: Various types of toxicological agents. (K1, K2, K3, K4, K5)
4.4: Toxicity testing principles, hazards, risks and their control methods. (K1, K2, K3, K4, K5)
4.5: Heavy metal toxicity – Estimation of mercury by Dithizone Colorimertic method, Estimation of fluoride by Diphenyl Carbozide Colorimetric method. (K1, K2, K3, K4, K5)
4.6: Estimation of Chromium by Diphenyl Carbozide Colorimetric method. (K1, K2, K3, K4, K5)

Unit 5: **(18 Hours)**

5.1: Aquatic environment **–** Toxicants and toxicity. (K1, K2, K3, K4, K5)
5.2: Factors that affect the environmental concentrations of the toxicants. (K1, K2, K3, K4, K5, K6)
5.3: Factors that influence toxicity. (K1, K2, K3, K4, K5)
5.4: Effect on aquatic Fauna. (K1, K2, K3, K4, K5)
5.5: Toxicity test: Acute toxicity test - chronic toxicity test - LC 50 – LD 50. (K1, K2, K3, K4, K5)
5.6: Factors that modify toxicity. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. V.K.Agarwal, Usha Gupta 2002 - Ecology and Ethology- S. Chand and Company Ltd.
2. S.N Prasad 1991- An Introduction to Toxicology- S. Chand and Company Ltd.

Reference Books:

3. H.R Singh, Neeraj Kumar 2006 - Ecology and Environmental Science - Vishal Publishing Co.
4. G T Tonapi 1950 - Fresh Water animal of India an ecological approach - Oxford and IBH Publishing Co.
5. Alexander J Horne, Charles R. Goldman 1994- Limnology- McGraw- Hill International editions.
6. Modern concepts of ecology H.D. Kumar 1995 - Vikas Publishing House Pvt. Ltd., New Delhi.
7. Ecology of Freshwater, Alison Leadlay Brown 1971, Heinemann Educational Books Ltd., London.
8. Introduction to Ecology, Papul A. Colinvaux, 1978 John Wiley and Sons, Inc., New York.
9. Fish and Fisheries of India V.G. Jhingram, 1980 Hindustan Publishing Co., New Delhi.
10. Peter Gomes Dayal 2011- Environmental Toxicology- Dominant Publishers and Distributors.
11. Krishna Pillai N. 1986- Introduction to Planktonology 1 ed - Himalaya Publishing House.
12. Manivasakam. N. Physico chemical examination of water, sewage and industrial effluents. Pragati Prakashan, Meerut.

E-Resources:

https://limnology.org
https://www.aslo.org
http://www.geocities.ws/limsocindia/limlinks.htm
https://www.toxicology.org
https://www.setac.org
http://www.indiansocietyoftoxicology.org

SEMESTER III

PCZOK20 - ANIMAL BEHAVIOUR

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PCZOK20	Animal Behaviour	Theory	Core	6	4	100

Objective:

- This paper has been designated to highlight the Behavioural strategies and adaptations of animals for their survival.

Course Outcomes:

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

CO1: Discuss the innate, acquired and group behaviours.

CO2: Explain the habitat selection and foraging methods of animals.

CO3: Compute the interspecific behaviours.

CO4: Explain about communication in animals.

CO5: Analyze Social behaviours in animals.

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	H	M
CO2	H	M	H	H	H	H
CO3	H	H	H	H	H	M
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PLO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	M
CO2	H	H	H	H	M	M
CO3	H	H	H	H	M	M
CO4	H	H	H	H	M	M
CO5	H	H	H	H	M	M

Unit 1: **(18 Hours)**

1.1: Ethology – Definition. (K1, K2, K3, K4, K5)

1.2: Biorhythms and biological clocks. (K1, K2, K3, K4, K5)

1.3: Instinct and learning. (K1, K2, K3, K4, K5)

1.4: Cognition. Group Behaviour - Stereotyped and acquired Behaviour. (K1, K2, K3, K4, K5)

1.5: Learning. (K1, K2, K3, K4, K5)

1.6: Memory. (K1, K2, K3, K4, K5)

Unit 2: **(18 Hours)**

2.1: Habitat selection - Dispersal, environmental signals for dispersal. (K1, K2, K3, K4, K5)
2.2: Habitat imprinting, tradition, theory of habitat selection. Homing. (K1, K2, K3, K4, K5, K6)
2.3: Foraging methods - Prey model, patch model. (K1, K2, K3, K4, K5)
2.4: Techniques for acquiring food. (K1, K2, K3, K4, K5)
2.5: Modifying food supply. Construction of traps, electromagnetic fields. (K1, K2, K3, K4, K5)
2.6: Territorialism. (K1, K2, K3, K4, K5)

Unit 3: **(18 Hours)**

3.1: Anti-predator Behaviour - Individual strategies- escaping and freezing. (K1, K2, K3, K4, K5)
3.2: Anti-predator Behaviour - Individual strategies- Deception, toxicity. (K1, K2, K3, K4, K5)
3.3: Anti-predator Behaviour - Individual strategies- Mimicry, distraction, displays. (K1, K2, K3, K4, K5)
3.4: Social strategies – Host - parasite relation. (K1, K2, K3, K4, K5)
3.5: Individual Behaviour – Conflict. (K1, K2, K3, K4, K5)
3.6: Aggression. (K1, K2, K3, K4, K5)

Unit 4: **(18 Hours)**

4.1: Communication in animals – Types. (K1, K2, K3, K4, K5)
4.2: Sound - Alarm calls, sonar in bats. (K1, K2, K3, K4, K5)
4.3: Neurobiology of Bird song. (K1, K2, K3, K4, K5)
4.4: Language acquisition by Humans and Apes. (K1, K2, K3, K4, K5, K6)
4.5: Chemical communication – Pheromones - Insect pheromones and vertebrate pheromones. (K1, K2, K3, K4, K5)
4.6: Visual communication. (K1, K2, K3, K4, K5)

Unit 5: **(18 Hours)**

5.1: Social Behaviour. (K1, K2, K3, K4, K5)
5.2: Social organization in Insects. (K1, K2, K3, K4, K5)
5.3: Social organization in Mammals. (K1, K2, K3, K4, K5)
5.4: Advantages of social Behaviour. (K1, K2, K3, K4, K5)
5.5: Reproductive Behaviour. (K1, K2, K3, K4, K5)
5.6: Courtship in birds. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Reena Mathur 1996 - Animal Behaviour-Rastogi and Co.
2. Amita Sarkar 2004 - Social behaviour in animal- Discovery Publishing house.

Reference Books:

3. Niko Tinbergen 1968- Animal Behaviour-LIFE young readers' library.
4. Aubrey Manning, Marian Stamp Dawkins 2013 - An Introduction to Animal Behaviour 5ed-Cambridge University press.
5. Michael J. Ryan, Walter Wilczynski 2011- An introduction to Animal Behaviour- An integrative approach- Cold Spring Harbour Laboratory Press.
6. M.M Ranga 2013 - Animal Behaviour- Saraswati Purohit for student's edition.
7. E.G Boulenger 2003 - An introduction to Animal Behaviour – Discovery Publishing House.
8. Hoshang S. Gundevia, Hare Goving Singh 1996 – A textbook of Animal Behaviour-S. Chand and Company Ltd.
9. V.K Agarwal 2013- Animal Behaviour (Ethology) - S. Chand and Company Ltd.
10. V.K Agarwal, Usha Gupta 2002- Ecology and Ethology- S. Chand and Company Ltd.

E-Resources:

https://www.animalbehaviorsociety.org
https://www.asab.org
http://www.behavecol.com

SEMESTER III

PEZOE20 - ELECTIVE III A: CLINICAL LABORATORY TECHNIQUES

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PEZOE20	Clinical Laboratory Techniques	Theory	Elective	5	5	100

Objective:

To imbibe the knowledge in the laboratory techniques which are applied to humans in day to day life.

Course Outcomes:

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

CO1: Develop technical knowledge in laboratory practices and apparatus maintenance.

CO2: Examine blood composition and basic hematological techniques.

CO3: Justify the pathology of diseases caused by parasites, virus, bacteria & fungus.

CO4: Discuss experimental techniques and methods of urine analysis.

CO5: Analyze the results of physical, microscopic and biochemical analysis of body fluids.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

Unit 1: **(15 Hours)**

1.1: Scope of Clinical laboratory technique (CLT). (K1, K2, K3, K4, K5)

1.2: Management and administration. (K1, K2, K3, K4, K5)

1.3: First aid in Laboratories. (K1, K2, K3, K4, K5)

1.4: General lab apparatus and general procedures, glass wares used in CLT studies. (K1, K2, K3, K4, K5)

1.5: Sterilization. (K1, K2, K3, K4, K5)

1.6: Disposal of infected materials. (K1, K2, K3, K4, K5)

Unit 2: **(15 Hours)**

2.1: Hematology – Blood. Haemopoesis. (K1, K2, K3, K4, K5)
2.2: Collection – Capillary and venipunture. Anticoagulants. (K1, K2, K3, K4, K5)
2.3: Basic hematology techniques - TC, DC, PCV, ESR, RBC fragility test. (K1, K2, K3, K4, K5, K6)
2.4: Clotting time, bleeding time, prothrombin time, GOD/POD. (K1, K2, K3, K4, K5, K6)
2.5: Blood grouping. (K1, K2, K3, K4, K5)
2.6: Platelets and its importance - blood coagulation. (K1, K2, K3, K4, K5)

Unit 3: **(15 Hours)**

3.1: Common Parasites of Man, life cycle and their Clinical diagnosis in body fluids- Blood- *Plasmodium vivax.* (K1, K2, K3, K4, K5)
3.2: Lymph - *Wuchereria bancrofti*. (K1, K2, K3, K4, K5)
3.3: CSF- toxoplasma, Perinicious malaria. (K1, K2, K3, K4, K5)
3.4: Clinical diagnosis of bacterial diseases – Typhoid. (K1, K2, K3, K4, K5)
3.5: Clinical diagnosis of viral disease - Hepatitis B. (K1, K2, K3, K4, K5)
3.6: Clinical diagnosis of Fungal Infections – Candidiasis. (K1, K2, K3, K4, K5)

Unit 4: **(15 Hours)**

4.1: Urine analysis – Physical - volume, appearance, colour, order. (K1, K2, K3, K4, K5)
4.2: Microscopic examinations for deposits, RBC, casts, pus cells. (K1, K2, K3, K4, K5)
4.3: Biochemical analysis - Estimation of sugar, albumin, bile pigments, bile salt and ketone bodies. (K1, K2, K3, K4, K5)
4.4: Semen analysis - Physical examinations. (K1, K2, K3, K4, K5)
4.5: Microscopic examinations - motility of sperms – sperm counting(K1, K2, K3, K4, K5)
4.6: Vaginal analysis - Microscopic examinations – Pap smear. (K1, K2, K3, K4, K5)

Unit 5: **(15 Hours)**

5.1: CSF - Collection, Physical examinations; Microscopic examinations; Biochemical analysis. (K1, K2, K3, K4, K5)
5.2: Gastric juice – Collection - Test for resting gastric content, Detection and estimation of gastric juice secretions. (K1, K2, K3, K4, K5)
5.3: Liver function test - Liver functions, estimation of serum bilirubin, serum enzymes, serum proteins. (K1, K2, K3, K4, K5, K6)
5.4: Estimation of cavity fluids - Pericardial, Pleural, peritoneal, Amniotic and for physical, chemical, cytological examination. (K1, K2, K3, K4, K5)
5.5: Stool analysis - Appearance, Composition, Collection, Physical, Chemical, microscopical examinations. (K1, K2, K3, K4, K5)
5.6: Examination for intestinal parasites. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks;

1. Kanai, L. Mukerjee, Medical laboratory technology, Vol I, II, III Tata McGraw Hill, Publishing Co., New Delhi, 1988.

Reference Books:

2. Arumugam N. Microbiology (General and Applied) Saras Publication, Nagercoil. 2013
3. John Bernard Henry Clinical Diagnosis & Management - W.B. Saunders Company. 1986
4. A Text Book of Microbiology, P. Chakraborty, New Central Book Agency (P) Ltd. Kolkata, India. 1995.

E-Resources:

https://www.indiaeducation.net
https://www.encyclopedia.com
https://medicallabtechnicianschool.org

SEMESTER III

PEZOF20 - ELECTIVE III B: FISHERIES SCIENCE

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PEZOF20	Fisheries Science	Theory	Elective	5	5	100

Objective:

- The aim of the paper is to understand the morphology, classification and identification of fishes and the fisheries and fishery resources of India.

Course Outcomes:

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

CO1: Explain the morphology and physiology of Indian fishes.

CO2: Analyze the environmental and nutritional requirements of fishes.

CO3: Understand the types, distribution and scope of inland fisheries.

CO4: Impart theoretical knowledge on surveying methods of fishery resources.

CO5: Acquire knowledge on various threats and conservation strategies of Indian fishes.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

Unit 1: **(15 Hours)**

1.1: General morphology and outline classification of fish. (K1, K2, K3, K4, K5)

1.2: Major groups of fish and their characteristics – morphometric and meristic characters of elasmobranchs and teleost fishes. (K1, K2, K3, K4, K5)

1.3: Basic anatomy of fish – digestive, circulatory, respiratory, nervous and reproductive system. (K1, K2, K3, K4, K5)

1.4: Food and feeding habits. (K1, K2, K3, K4, K5)

1.5: Maturity, fecundity, spawning. (K1, K2, K3, K4, K5)

1.6: Survival of Indian fish. (K1, K2, K3, K4, K5, K6)

Unit 2: **(15 Hours)**

2.1: Length-weight relationship. (K1, K2, K3, K4, K5)
2.2: Factors influencing growth condition factor, age determination. (K1, K2, K3, K4, K5)
2.3: Theory of fishing. (K1, K2, K3, K4, K5)
2.4: Unit stock, recruitment. (K1, K2, K3, K4, K5)
2.5: Growth, mortality, migration. (K1, K2, K3, K4, K5)
2.6: Fish tagging and marking. (K1, K2, K3, K4, K5)

Unit 3: **(15 Hours)**

3.1: Fishery zones in India. (K1, K2, K3, K4, K5)
3.2: Types of fisheries in India – Riverine, Estuarine, Coldwater, Reservoir and Pond fisheries. (K1, K2, K3, K4, K5)
3.3: Present status and scope of inland capture fisheries – their fishery characterizes, distribution and importance. (K1, K2, K3, K4, K5)
3.4: Present status and scope of marine capture fisheries – crustaceans (Prawn/shrimp, lobster and crabs). (K1, K2, K3, K4, K5)
3.5: Present status and scope of marine capture fisheries Molluscs (clam, cockle, mussel, oyster, cephalopods). (K1, K2, K3, K4, K5)
3.6: Present status and scope of marine capture fisheries Fishes – their fishery characteristics, distribution and importance. (K1, K2, K3, K4, K5)

Unit 4: **(15 Hours)**

4.1: Methods of surveying the fishery resources- Acoustic method. (K1, K2, K3, K4, K5, K6)
4.2: Methods of surveying the fishery resources - Aerial method. (K1, K2, K3, K4, K5)
4.3: Survey of fish eggs and larvae. (K1, K2, K3, K4, K5)
4.4: Analyzing population features. (K1, K2, K3, K4, K5)
4.5: Growth mortality selection. (K1, K2, K3, K4, K5)
4.6: Collection of eggs. (K1, K2, K3, K4, K5)

Unit 5: **(15 Hours)**

5.1: Principle methods of exploitation of fish. (K1, K2, K3, K4, K5)
5.2: Indigenous and modern gears and crafts. (K1, K2, K3, K4, K5)
5.3: Principle methods of fish preservation and processing in India. (K1, K2, K3, K4, K5)
5.4: Types of spoilage, causative factors. (K1, K2, K3, K4, K5)
5.5: Marketing. (K1, K2, K3, K4, K5)
5.6: Economics. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Day F. 1981 – Fishes of India, Vol. I and Vol. II – William Sawson &Sons Ltd., London.
2. Jhingran C.G. 1981 – Fish and Fisheries of India – Hindustan Publishing Co., India.

Reference Books:

3. Maheswari K. 1993 – Common Fish Diseases and Their Control – Institute of Fisheries Education, Powakads, M.P.
4. Santhanam R. 1980 – Fisheries Science – Daya Publishing House, New Delhi.
5. Yadav B.N. 1997 – Fish and Fisheries - Daya Publishing House, New Delhi
6. Bal. D.V, Rao K.V. 1990 – Marine Fisheries of India – Tata McGraw Hill Publishing Co. Ltd., New York.
7. Biswas K.P.1996 – A Textbook of Fish, Fisheries and Technology – Narendra Publishing House, Delhi.
8. Srivastava C.B.L. 1999 – Fish Biology – Narendra Publishing House, Delhi.

E-Resources:

https://aimlta.org
https://www.mccc.edu
https://researchguides.austincc.edu

SEMESTER IV

PCZOM20 - PHYSIOLOGY AND ENDOCRINOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	IV	PCZOM20	Physiology and Endocrinology	Theory	Core	7	4	100

Objective:

- To enable students to understand the Structural and functional aspects of systems, the basic concept of Enzymes and Gastrointestinal hormones and the functions of hormones in the body.

Course Outcomes:

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

CO1: Expand knowledge about the enzymes, digestive system and interaction of complex metabolic pathway, respiration and the adaptation at extreme conditions.

CO2: Summarize the circulatory and excretory system with its structure, function and regulatory mechanism.

CO3: Discuss the muscular and nervous system structure, function and regulation.

CO4: Describe hormones its classification and function, the anatomy of endocrine glands.

CO5: Interpret endocrine system with its function and regulation in reproduction.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	M	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	M

Unit 1: PHYSIOLOGY (21 Hours)

1.1: Digestion and absorption. Role of gastrointestinal hormones. (K1, K2, K3, K4, K5)

1.2: Carbohydrates Proteins and Lipids Metabolism. (K1, K2, K3, K4, K5, K6)

1.3: Respiration- Mechanism of respiration. Nervous and chemical control of respiration. (K1, K2, K3, K4,K5)

1.4: Acid – base balance. (K1, K2, K3, K4, K5)

1.5: Body Mass Index (BMI). (K1, K2, K3, K4, K5)

1.6: Basal Metabolic Rate (BMR). (K1, K2, K3, K4, K5)

Unit 2: **(21 Hours)**

2.1: Circulation: Structure of heart, Properties of Cardiac muscle. (K1, K2, K3, K4, K5)
2.2: Cardiac Cycle, Origin and conduction of Heart beat. (K1, K2, K3, K4, K5)
2.3: Hormonal and neural regulation of Circulation. (K1, K2, K3, K4, K5)
2.4: Excretion – Structure of Kidney, Blood supply. (K1, K2, K3, K4, K5)
2.5: Urine Formation – Micturition. (K1, K2, K3, K4, K5)
2.6: Neural, hormonal regulation of urine formation in man. (K1, K2, K3, K4, K5)

Unit 3: **(21 Hours)**

3.1: Muscles – Skeletal muscle - Anatomy of muscle fiber – muscle proteins. (K1, K2, K3, K4, K5)
3.2: Physiology of muscle contraction- Mechanism of Muscle contraction theories. (K1, K2, K3, K4, K5, K6)
3.3: Smooth Muscle – Types - Multi unit, Visceral; Calcium - Calmodulin role in Smooth muscle contraction. (K1, K2, K3, K4, K5)
3.4: Nervous System – Brain and spinal cord and reflex action. (K1, K2, K3, K4, K5)
3.5: Sympathetic and parasympathetic system. (K1, K2, K3, K4, K5)
3.6: Neurons, transmissions of nerve impulse, neurotransmitters. (K1, K2, K3, K4, K5)

Unit 4: ENDOCRINOLOGY **(21 Hours)**

4.1: Endocrine glands in Mammals. (K1, K2, K3, K4, K5)
4.2: Hormones – Classification, function and chemical nature. (K1, K2, K3, K4, K5)
4.3: Physiology of endocrine glands – Pituitary gland. (K1, K2, K3, K4, K5)
4.4: Physiology of endocrine glands -Pancreas gland. (K1, K2, K3, K4, K5)
4.5: Physiology of endocrine glands - Thyroid gland. (K1, K2, K3, K4, K5)
4.6: Physiology of endocrine glands- Adrenal gland. (K1, K2, K3, K4, K5)

Unit 5: **(21 Hours)**

5.1: Endocrinology and Reproduction. (K1, K2, K3, K4, K5)
5.2: Physiology of Mammalian reproductive hormones - Testis (K1, K2, K3, K4, K5)
5.3: Physiology of Mammalian reproductive hormones - Ovary. (K1, K2, K3, K4, K5)
5.4: Estrous and menstrual cycle. (K1, K2, K3, K4, K5)
5.5: Neuroendocrine regulation of Pregnancy. (K1, K2, K3, K4, K5)
5.6: Parturition and Lactation. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbook:

1. Hoar, W.S. 1999. General and comparative physiology, prentice Hall, New Delhi.
2. Guyton, A. 2001. Textbook of Medical physiology, Tenth Edition, W.B. Saunders, London.

Reference Book:

3. Lohar, P.S. 2005. Endocrinology: Hormones Human Health, MJP Publishers Chennai.
4. Elaine N. Marieb, 2006. Human Anatomy and Physiology, Sixth Ed. Dorling Kindersley. (India) Pvt. Ltd.
5. Herkat P.C. and Mathur P.N. 1976. – Textbook of Animal Physiology – S. Chand Co. Pvt. Ltd., New Delhi.
6. Haris G.W. and Donovan B.T., 1968. The Pituitary Gland- S. Chand and Co.
7. Turner, C.D. and Bangara J.T. 1986 General Endocrinology- Saunders International Student Edition, Toppan Company Limited Tokyo,
8. Barrington E.J.W. 1985, An introduction to General and Comparative Endocrinology- Claredon press Oxford.

E-Resources:

https://www.physoc.org/explore-physiology
https://www.physiology.org
https://www.innerbody.com/htm

SEMESTER IV

PCZON20 - DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
II	IV	PCZON20	Developmental Biology and Immunology	Theory	Core	6	4	100

Objectives:

- To imbibe the current knowledge pertaining to the formation and development of embryos.
- To understand the fundamental aspects and basic patterns of animal development.
- To understand the importance of cells in immune system.
- To understand the application of immunology in the treatment of diseases.

Course Outcomes:

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

CO1: Explain the chemo differentiation in the egg during development.

CO2: Describe the organizer and cellular differentiation, genetic defects, aging regeneration and teratogenesis.

CO3: Discuss the various forms of asexual reproduction, artificial fertilization and stem cells.

CO4: Summarize the cells of Immune system and immune response.

CO5: Explain the importance of immune therapy in treatment of diseases.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	L	H	L	M
CO2	H	H	L	H	L	M
CO3	H	H	M	H	L	M
CO4	H	H	L	H	L	M
CO5	H	H	L	H	L	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	M	L	L
CO2	H	H	H	M	M	L
CO3	H	H	H	M	L	M
CO4	H	H	H	H	L	L
CO5	H	H	M	H	L	M

Unit 1: DEVELOPMENTAL BIOLOGY (18 Hours)

1.1: Chemo differentiation: Nucleus of Cleavage cells. (K1, K2, K3, K4, K5)

1.2: Distribution of cytoplasmic substances in the egg during cleavage. (K1, K2, K3, K4, K5)

1.3: Role of egg cortex. (K1, K2, K3, K4, K5)

1.4: Nucleocytoplasmic interactions. (K1, K2, K3, K4, K5)

1.5: Role of maternal genes during early development. (K1, K2, K3, K4, K5)

1.6: Involvement of paternal genes in the control of development. (K1, K2, K3, K4, K5, K6)

Unit 2: (18 Hours)

2.1: Organizer: Spemann's primary organizer – analysis of nature and mechanism of induction. (K1, K2, K3, K4, K5)
2.2: Nuclear transplantation – Cellular differentiation and protein synthesis. (K1, K2, K3, K4, K5, K6)
2.3: Differential activation – Developmental genetic defects. (K1, K2, K3, K4, K5)
2.4: Role of cell death in development. Aging. (K1, K2, K3, K4, K5, K6)
2.5: Regeneration. (K1, K2, K3, K4, K5)
2.6: Teratogenesis. (K1, K2, K3, K4, K5)

Unit 3: (18 Hours)

3.1: Asexual reproduction – Occurrence and forms of asexual reproduction. (K1, K2, K3, K4, K5)
3.2: Cloning – Artificial fertilization - embryo transfer. (K1, K2, K3, K4, K5)
3.3: Stem cell research and its significance. (K1, K2, K3, K4, K5, K6)
3.4: Asymmetric division of stem cells vs embryonic stem cell. (K1, K2, K3, K4, K5)
3.5: Therapeutic cloning – stem cell therapy. (K1, K2, K3, K4, K5)
3.6: Ethical issues of Stem cell. (K1, K2, K3, K4, K5)

Unit 4: IMMUNOLOGY (18 Hours)

4.1: Cells of Immune system – Stem Cells, Lymphoid cells, mononuclear cells, Granulocytes, Mast cells, Dendrite cells. (K1, K2, K3, K4, K5)
4.2: Immunoglobulin - structure, isotypes and biological function. (K1, K2, K3, K4, K5)
4.3: Antigenic determinants on immunoglobulin - isotype, allotype and idiotype. (K1, K2, K3, K4, K5)
4.4: B cell Receptors, T cell Receptors. (K1, K2, K3, K4, K5, K6)
4.5: Antigen – Antibody interaction. (K1, K2, K3, K4, K5)
4.6: MHC – Structure, Antigen processing and Presentation. (K1, K2, K3, K4, K5)

Unit 5: (18 Hours)

5.1: Transplantation Immunology – Types of grafts (Auto, Iso, Allo and Xeno). (K1, K2, K3, K4, K5)
5.2: Process of Graft Acceptance and Graft Rejection. (K1, K2, K3, K4, K5)
5.3: Immunosuppressive Therapy. (K1, K2, K3, K4, K5, K6)
5.4: Vaccines-Principles and types of vaccines-DNA Recombinant Vaccines. (K1, K2, K3, K4, K5, K6)
5.5: Autoimmunity. (K1, K2, K3, K4, K5)
5.6: HIV/AIDS. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Balinsky B.I. 1981 - An Introduction to Embryology- W.B. Saunders, Co., Philadelphia.
2. Karp G. and Berrill N.J. 1981- Development – McGraw Hill, New York.

Reference Books:

3. Ebert J.D. 1970 - Interacting Systems - Holt Reinhart and Winston, Inc., New York and Chicago.
4. Grant P. 1978 - Biology of Developing Systems - Holt Reinhart and Winston, Inc., New York and Chicago.
5. Saunders J.W. 1982 - Developmental Biology - McMillan Co., London.
6. Nagabhushanam R., Sarojini R., 2002 - Invertebrate Embryology - Oxford IBA Publishing Co.
7. Tyagi Rajiv and Shukla A.N., 2002 - Development of Fishes - Jaya Publishing House, New Delhi.
8. Gibert Scott F. 2003 - Developmental Biology - Sinamer Associates Inc Saunderland Massachusets, U.S.A.
9. Oppenheimer S.B. 1980 - Introduction to Embryonic Development - Allyn and Bacon, Inc., U.S.A.
10. Richard A. Goldsby Thomas Kindt T., Barbara A Osborne, 2000 - Kuby Immunology – Freeman and Co., New York.
11. Roitt I.M.1994 - Essential Immunology - Blackwell Scientific Oxford.
12. Paul W.E.M. 1989 - Fundamentals of Immunobiology - Raven Press, New York.
13. Srivastava R., Ram B.P., Tyle P., 1991 - Molecular Mechanism of Immune Regulation - VCH Publishers, New York.
14. Kannan I. 2013 – Immunology - MJP Publishers, Chennai.

E-Resources:

https://embryology.med.unsw.edu.au
http://www.embryology.ch
https://www.immunology.org
https://www.ncbi.nlm.nih.gov

SEMESTER IV

PCZOO20 – EVOLUTION

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	IV	PCZOO20	Evolution	Theory	Core	6	4	100

Objectives:

- To comprehend the scientific concepts of animal evolution through an understanding of its evidences, its mechanics, process and products.

Course Outcomes:

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

CO1: Analyse the evidences of evolution, and importance of paleontology.

CO2: Compare the evolutionary theories, trends and mechanism of evolution.

CO3: Justify the adaptations for successful continuation of life and extinction.

CO4: Appraise the distribution of animals and geological time scale.

CO5: Explain the Human origin and evolution.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

Unit 1: **(18 Hours)**

1.1: Evidences For Evolution from Taxonomy. (K1, K2, K3, K4, K5)

1.2: Comparative anatomy and Paleontology. (K1, K2, K3, K4, K5)

1.3: Fossils – Formation, Fossilization - Types of Fossils. (K1, K2, K3, K4, K5)

1.4: Evaluation using fossils. (K1, K2, K3, K4, K5, K6)

1.5: Significance of fossils, Living fossils. (K1, K2, K3, K4, K5)

1.6: Dating of fossils - Lead method, Radio-Carbon method. (K1, K2, K3, K4, K5, K6)

Unit 2: **(18 Hours)**

2.1: Neo-Lamarckism; Neo-Darwinism. (K1, K2, K3, K4, K5)
2.2: Micro, macro and mega evolution. (K1, K2, K3, K4, K5)
2.3: Isolation and isolating mechanisms. (K1, K2, K3, K4, K5)
2.4: Race formation; Selection natural, artificial and sexual. (K1, K2, K3, K4, K5)
2.5: Trends in Evolution - Neotony - Types, Factors and evolutionary significance; Atavism. (K1,K2, K3, K4, K5, K6)
2.6: Orthogenesis - Mechanism, Orthoselection, Evidences. (K1, K2, K3, K4, K5)

Unit 3: **(18 Hours)**

3.1: Adaptation - Structural adaptation - Cursorial, Fossorial. (K1, K2, K3, K4, K5)
3.2: Adaptation - Structural adaptation - Arboreal, Desert, Aquatic. (K1, K2, K3, K4, K5)
3.3: Adaptation - Structural adaptation - Volant, Cave, Deep Sea. (K1, K2, K3, K4, K5)
3.4: Protective adaptation - Cryptic, Warning, Mimicry. (K1, K2, K3, K4, K5)
3.5: Extinction- Types of extinction, Causes, Significance of extinction. (K1, K2, K3, K4, K5)
3.6: Extinct animals. (K1, K2, K3, K4, K5)

Unit 4: **(18 Hours)**

4.1: Animal distribution – Kinds of Distribution – In space. (K1, K2, K3, K4, K5)
4.2: Geographic – Zoogeographic realms. (K1, K2, K3, K4, K5)
4.3: Barriers and Dispersal, Means of dispersal; Bathymetric – Geobiotic, Limnobiotic, Halobiotic. (K1, K2, K3, K4, K5)
4.4: In Time – Geological Time scale and Geologic Distribution. (K1, K2, K3, K4, K5)
4.5: Patterns of Distribution. (K1, K2, K3, K4, K5)
4.6: Insular fauna - Oceanic islands, Continental islands. (K1, K2, K3, K4, K5)

Unit 5: **(18 Hours)**

5.1: History of Primates. (K1, K2, K3, K4, K5)
5.2: Classification of Primates. (K1, K2, K3, K4, K5)
5.3: Evolution of Man- Structural and Chemical similarities and differences. (K1, K2, K3, K4, K5)
5.4: Man in fossil record - Java man, Peking man, Heidelberg man. (K1, K2, K3, K4, K5)
5.5: Swanscombe man, Neanderthal man, Cromagnon man. (K1, K2, K3, K4, K5)
5.6: Cultural Evolution of Man. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

Organic Evolution 2010 – Richard Swann Lull, Maxford Books, New Delhi.
1. Evolution of the vertebrates, 1969 – Edwin H. Colbert, Wiley Eastern, New Delhi.

Reference Books:

2. T.S Gopalakrishnan, Itta Sambasivaiah, A P Kamalakara Rao 1983- Principles of Organic evolution - Pearl Publications.
3. Kavitha 2013 - Organic Evolution - A.I.T.B.S Publishers India.
4. Edward O. Dodson 1960 - Evolutionary Process and Distribution- Reinhold Publishing Corporation.
5. P.C Jain, M.S. Anantharamam 2000 – Paleontology- Evolution and animal distribution Vishal Publications.
6. A.P Tyagi 1989 - An introduction to Paleontology- S. Chand and company limited.

E-Resources:

http://www.evolutionoftheweb.com
https://evolution.berkeley.edu/evolibrary/home.php
https://www.oercommons.org

SEMESTER IV

PCZOP20 - PRACTICAL III - ENVIRONMENTAL BIOLOGY, LIMNOLOGY, TOXICOLOGY AND ANIMAL BEHAVIOUR

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
II	III & IV	PCZOP20	Practical III	Practical	Core	3	4	100

Course Learning Outcomes:

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

CO1: Perform practical procedures in ecology.

CO2: Describe the adaptive features of animals with reference to their habitat and ethology.

CO3: Prepare slides of planktons.

CO4: Perform Toxicology studies.

CO5: Discuss water treatment through water treatment plant visits.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	M
CO2	H	H	H	H	M	M
CO3	H	H	H	H	L	M
CO4	H	H	H	H	H	M
CO5	H	M	H	H	H	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	M
CO3	H	H	H	H	L	M
CO4	H	H	H	H	H	M
CO5	H	H	H	H	M	M

I. ENVIRONMENTAL BIOLOGY

1. Estimation:
    a) Estimation of dissolved Oxygen
    b) Estimation of CO_2
    c) Estimation of Salinity
    d) Estimation of Carbonates and Bicarbonates

2. Analysis of Industrial effluent – BOD

3. Study of different fauna with special reference to the adaptations:
    a) Study of Sandy shore fauna
    b) Study of Muddy shore fauna

c) Study of Rocky shore fauna

II. LIMNOLOGY AND TOXICOLOGY

4. Estimation:
    a) Estimation of Chromium
    b) Estimation of Nitrites
    c) Estimation of Phosphates

5. Mounting:
    a) Observation of fresh water planktons
    b) Observation of marine planktons

6. Lentic Adaptations: Daphnia, Crab, Prawn, Clams, Snail, Water Strider, Salamander, Alligator

7. Lotic Adaptations: Limpet, Crayfish, Salmon, Eel, Crocodile, Hippopotamus, Brook trout, Lung fish.

8. Toxicity induced diseases: a) Minamata disease b) Itai-itai c) Painter's colic

9. Visit to water treatment plant.

III. ANIMAL BEHAVIOUR:

10. Animal Association
a.) Parasitism
i) Ectoparasites – Ticks, Mites
ii) Endoparasites – *Taenia solium, Ascaris lumbricoides*
b.) Mutualism – Termites and Trichonympha, Sea Anemone and Hermit Crab
c) Commensalisms – Shark and Echeneis, Whale and Barnacles
d) Parental Care in Fish – Hippocampus, Male ring- tailed Cardinals, Gouramis
e) Parental Care in Amphibians – Midwife toad, Icthyophis, Marsupial frog.

SEMESTER IV

PCZOQ20 - PRACTICAL IV

PHYSIOLOGY, ENDOCRINOLOGY, DEVELOPMENTAL BIOLOGY, IMMUNOLOGY AND EVOLUTION

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III & IV	PCZOQ20	Practical- IV	Practical	Core	3	4	100

Course Outcomes:

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

CO1: Analyze physiological parameters.

CO2: Interpret Endocrine glands and Endocrine disorders.

CO3: Explain immunological importance of WBC and principle on antigen antibody reaction in ABO grouping.

CO4: Identify the developmental stages, placenta, and histology in development biology.

CO5: Compare the evolutionary significance, mimicry and adaptation in animals.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	M	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	M	H

Physiology

a) Estimation of RQ in Fish with reference to temperature.
b) Salt loss and Salt gain in fish.
c) Study of Human salivary amylase activity in relation to temperature
d) Study of Human salivary amylase activity in relation to pH
e) Oxygen consumption by fish in relation to body weight
f) Estimation of digestive enzyme activity in Cockroach

Endocrinology:

a) Slides: Pituitary gland, Thyroid gland, Parathyroid gland , Adrenal gland, Pancreas.
b) Abnormalities of hormones: Hypersecretion – Gigantism, Grave's disease, Cushing's syndrome.
c) Hyposecretion- Dwarfism, Cretinism, Myxoedema, Addison's disease.

Developmental Biology and Immunology

a) Immunoelectrophoresis – chart
b) Immunodiffusion - chart
c) Antigen and Antibody reaction – ABO Blood grouping
d) Differential count of WBC
e) Pregnancy test

Spotters/Charts/ Slides

a) Blastula and Gastrula of Frog
b) T.S of Testis – T.S. of Ovary – Graffian Follicles (mammals)
c) Placentation – Placenta of Shark and Sheep
d) Embryo of Mammals – Sheep and Pig
e) Developmental stages in Chick – 18 hours, 24hrs, 48hrs, and 72hrs
f) Histology of Lymphoid organs – Thymus, Spleen, Bone marrow, Lymph node

Evolution:

Spotters/Charts/ Slides

a) Evolutionary importance of Peripatus, Limulus, Tornaria
b) Adaptations – Arboreal - Squirrel, Fossorial- Rat, Cursorial- Ostrich and Aerial- Bat
c) Cryptic coloration -Leaf and stick insects
d) Batesian mimicry - Monarch and Viceroy butterflies.
e) Study of Paleontological Fossils - Trilobites, Ammonites, Seymouria, Nautilus.

SEMESTER IV

PEZOG20 - ELECTIVE IV A: FISHERY BIOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	IV	PEZOG20	Fishery Biology	Theory	Elective	5	5	100

Objective:

- The objective of the paper is to understand shell fisheries in India and to have knowledge about their byproducts, marketing, transportation and Insurance.

Course Outcomes:

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

CO1: Apply the parameters for the growth of fish, biology of fish and gears in fishery.

CO2: Acquire knowledge of biology and techniques of shell fisheries.

CO3: Apply knowledge in establishing and managing sea weed and pearl culture and byproducts of fishery.

CO4: Differentiate the types of fish cultures pathogens and their control measures.

CO5: Explain the processing, transportation and marketing of Fishes.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Unit 1: **(15 Hours)**

1.1: Water quality-temperature, pH, CLO2, salinity, nutrients and trace elements for the growth of fishes. (K1, K2, K3, K4, K5)

1.2: Biology of Marine edible fish - Oil sardines. (K1, K2, K3, K4, K5)

1.3: Biology of freshwater edible fish- Catla. (K1, K2, K3, K4, K5)

1.4: Indian capture methods – shafts. (K1, K2, K3, K4, K5)

1.5: Indaian capture gears. (K1, K2, K3, K4, K5)

1.6: Economic importance of commercial fisheries. (K1, K2, K3, K4, K5)

Unit 2: **(15 Hours)**

2.1: Biology and culture techniques of Shell fisheries. (K1, K2, K3, K4, K5)
2.2: Marine and freshwater Crustaceans- Prawns, Lobsters, Crabs. (K1, K2, K3, K4, K5)
2.3: Molluscs – Oysters. (K1, K2, K3, K4, K5)
2.4: Clams, Cuttle fish. (K1, K2, K3, K4, K5)
2.5: State wise Commercial and export potential of Shell fisheries. (K1, K2, K3, K4, K5)
2.6: Economic importance of Shell fisheries. (K1, K2, K3, K4, K5)

Unit 3: **(15 Hours)**

3.1: Sea weeds – Types. (K1, K2, K3, K4, K5)
3.2: Different culture methods of sea weeds. (K1, K2, K3, K4, K5)
3.3: Pearl culture - stages of pearl formations. (K1, K2, K3, K4, K5)
3.4: Pearl culture techniques. (K1, K2, K3, K4, K5, K6)
3.5: Byproducts of fishes - Fish meal – Fish oil. (K1, K2, K3, K4, K5)
3.6: Fish manure – Chanks. (K1, K2, K3, K4, K5)

Unit 4: **(15 Hours)**

4.1: Composite fish culture– Paddy cum fish culture. (K1, K2, K3, K4, K5)
4.2: Integrated fish culture. (K1, K2, K3, K4, K5)
4.3: Sewage water fish culture. (K1, K2, K3, K4, K5)
4.4: Raceway culture, cage, pen and rack culture system. (K1, K2, K3, K4, K5)
4.5: Control of Parasites, predators. (K1, K2, K3, K4, K5)
4.6: Weeds in culture ponds. (K1, K2, K3, K4, K5)

Unit 5: **(15 Hours)**

5.1: Methods of processing. (K1, K2, K3, K4, K5)
5.2: Packaging. (K1, K2, K3, K4, K5)
5.3: Storage of fishes. (K1, K2, K3, K4, K5)
5.4: Transport facilities. (K1, K2, K3, K4, K5)
5.5: Marketing channels. (K1, K2, K3, K4, K5)
5.6: E-marketing. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Jingran, V.G., 1982. Fish and fisheries of India. Hindustan publishing Corporation - New Delhi
2. Hepher, B and Y. Pruginin, 1981 - Commercial fish farming, John Wiley & Sons, N.Y. Marine Products Export Review, 1982 MPEDA, Cochin.

Reference Books:

1. Pandey, K and J.P Shukla 2000. Fish and Fisheries, Rastogi Publication, Meerut.
2. Shanmugam, K. 2005. Fishery Biology and Aquaculture
3. Pradeep Kashyap. 2005. The Rural Marketing Book.

E-Resources:

http://www.cifa.nic.in
http://agritech.tnau.ac.in
http://aquaculturetraining.com.au
http://www.oftri.org

SEMESTER IV

PEZOH20 - ELECTIVE IV B: AQUACULTURE AND FARM MANAGEMENT

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	IV	PEZOH20	Aquaculture and Farm Management	Theory	Elective	5	5	100

Objective:

- To understand the culture practices of both fin fish and shell fishes.
- Gaining knowledge in the food and feeding habits, investigating the seed production and farm management and method of farming.

Course Outcomes:

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

CO1: Describe parameters of aquatic environment for aquaculture and farm management.

CO2: Elucidate biological criteria and economic significance of cultivable species.

CO3: Discuss seed production and hatchery management of commercially important cultivable fishes.

CO4: Explain different types of fish cultures techniques.

CO5: Analyse water quality parameters and biotechnological tools in disease diagnosis of culture fishes.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	M	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	H	H

Unit 1: **(15 Hours)**

1.1: Overview - Importance of aquaculture. (K1, K2, K3, K4, K5)

1.2: Global scenario. (K1, K2, K3, K4, K5)

1.3: Present status in India-prospects and scope. (K1, K2, K3, K4, K5)

1.4: Aquaculture Farms - Site selection, topography. (K1, K2, K3, K4, K5)

1.5: Water availability and supply, soil conditions and quality. (K1, K2, K3, K4, K5)
1.6: Design and layout, farm design, structure and construction. (K1, K2, K3, K4, K5)

Unit 2: (15 Hours)

2.1: Standard guidance for choosing cultivable species- seaweed, Crustacean (Prawns and Lobsters). (K1, K2, K3, K4, K5)
2.2: Molluscs (Clams, Cockles, Mussels and Oysters) and fishes-biological criteria. (K1, K2, K3, K4, K5)
2.3: Environmental adaptability and compatibility. (K1, K2, K3, K4, K5)
2.4: Adaptability to intensive culture. (K1, K2, K3, K4, K5)
2.5: Economic importance-economics, market values. (K1, K2, K3, K4, K5)
2.6: By products and availability in adjacent region. (K1, K2, K3, K4, K5)

Unit 3: (15 Hours)

3.1: Distribution and abundance of natural seed resources, collection methods and segregation. (K1, K2, K3, K4, K5)
3.2: Artificial seed production-breeding under controlled condition. (K1, K2, K3, K4, K5)
3.3: Induced breeding technique, larval rearing, packing and transportation. (K1, K2, K3, K4, K5)
3.4: Live feed - Microalgae, Rotifer and Artemia - their culture. (K1, K2, K3, K4, K5)
3.5: Feed formulation - conventional and non-conventional ingredients. (K1, K2, K3, K4, K5)
3.6: Feed additives, feed attractants and feed formulations. (K1, K2, K3, K4, K5)

Unit 4: (15 Hours)

4.1: Traditional, Extensive, Semi-intensive and intensive systems, composite fish culture. (K1,K2, K3, K4, K5)
4.2: Paddy-cum-fish culture. (K1, K2, K3, K4, K5)
4.3: Integrated fish culture, sewage water fish culture, raceway culture. (K1, K2, K3, K4, K5)
4.4: Cage, pen and rack culture system management. (K1, K2, K3, K4, K5)
4.5: Pond preparation. (K1, K2, K3, K4, K5)
4.6: Production and economics. (K1, K2, K3, K4, K5)

Unit 5: (15 Hours)

5.1: Water quality - temperature, Salinity, pH, O2, CLO2, levels, nutrients and trace elements (K1, K2, K3, K4, K5)
5.2: Control of parasites, predators. (K1, K2, K3, K4, K5)
5.3: Weeds and diseases in culture ponds. (K1, K2, K3, K4, K5)
5.4: Disease diagnosis-ELISA, Western blotting. (K1, K2, K3, K4, K5)
5.5: DNA based diagnosis of diseases. (K1, K2, K3, K4, K5)
5.6: Fish vaccines. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Baluyut E.A., Aquaculture system and practices-A Selected Review Publishing House, New Delhi, 1989.
2. Dash M.C and Patnik. P.N.-Brackish water Culture-Palani Paramount Publications, Palani, 1994.

Reference Books:

3. Michael. B.N and Singholka B., Freshwater Prawn Farming: A Manual of Culture of Macrobarachium Rosenbergee - Daya Publishing House, New Delhi, 1985.
4. Paul Raj S. Shrimp Farming Techniques: Problems and Solutions- Palani Paramount Publication, Palani, 1995.
5. Post G.M.- Textbook of fish Health - TFH Publication, 1983
6. Sinha, V.R.P and Srinivastava H.C. - Aquaculture Productivity-Oxford and IBH Publications Co. Ltd., New Delhi, 1991.

E-Resources:

http://www.cifa.nic.in
http://agritech.tnau.ac.in
http://aquaculturetraining.com.au
http://www.oftri.org

SEMESTER I

PIZOA20 - INDEPENDENT ELECTIVE I A- PET KEEPING

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
I	I	PIZOA20	Pet Keeping	Theory	Independent Elective	-	2	100

Objective:

- To gain an extensive foundation for a career in the pet industry.
- To develop a career or business working with animals in breeding and supplying pets, or supplying services or products to pet owners.

Course Outcomes:

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

CO1: Analyze the present status of maintaining pets and its needs.

CO2: Interpret on varied dog breeds and train them.

CO3: Identify cat breeds and trace the diseased cat and treat them.

CO4: Expand knowledge on best choices of bird breed for business.

CO5: Elucidate commercially important fishes and understand the construction and requirement for setting aquarium to become an entrepreneur.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	M	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

Unit 1:

1.1: Animal care: laws and licenses. (K1, K2, K3, K4, K5)

1.2: Animal charities and societies (RSPCA, WSPA, Blue cross). (K1, K2, K3, K4, K5)

1.3: Pet trading. (K1, K2, K3, K4, K5)

1.4: Pet care needs -feeding, watering, shelter. (K1, K2, K3, K4, K5)

1.5: Containment, fencing, caging, and protection. (K1, K2, K3, K4, K5)

1.6: Maintaining health and hygiene. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Dogs: Selection – breeds. (K1, K2, K3, K4, K5)
2.2: Training – positive reinforcement for puppies. (K1, K2, K3, K4, K5)
2.3: Adult training; Reappraise basic training; teaching old dogs new tricks. (K1, K2, K3, K4, K5)
2.4: Illness- first aid on spot diagnosis- vomiting and diarrhea, poisoning. (K1, K2, K3, K4, K5)
2.5: Cuts, grazes, wounds and burns. (K1, K2, K3, K4, K5)
2.6: Breaks and fractures; shock. (K1, K2, K3, K4, K5)

Unit 3:

3.1: Cat: Breeds (Lang Haired, semi long haired, short haired, oriental). (K1, K2, K3, K4, K5)
3.2: Allergies-containment. (K1, K2, K3, K4, K5)
3.3: Breeding. (K1, K2, K3, K4, K5)
3.4: New born Kittens. (K1, K2, K3, K4, K5)
3.5: Care for sick cat signs of illness, temperature. (K1, K2, K3, K4, K5)
3.6: Common ailments, skin disorders -ticks. (K1, K2, K3, K4, K5)

Unit 4:

4.1: Birds: Selection. (K1, K2, K3, K4, K5)
4.2: Breeds (canaries, finches, budgerigars, small parrots). (K1, K2, K3, K4, K5)
4.3: Containment -Aviaries, selection, design and size. (K1, K2, K3, K4, K5)
4.4: Management-feeding -watering- Grooming (Wing trim, beak trim, nail trim). (K1, K2, K3, K4, K5)
4.5: Caring for sick bird. (K1, K2, K3, K4, K5)
4.6: Signs of illness and common ailments. (K1, K2, K3, K4, K5)

Unit 5:

5.1: Selection - Types of fish -Tropical, Marine, Cold water. (K1, K2, K3, K4, K5)
5.2: Costs, size, Equipments. (K1, K2, K3, K4, K5)
5.3: Tanks, Ponds, pumps, aquarium, night lights. (K1, K2, K3, K4, K5)
5.4: Water quality - changing water. (K1, K2, K3, K4, K5)
5.5: Feed -pelleted, live feed. (K1, K2, K3, K4, K5)
5.6: Illness -fungal, bacterial parasites. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Shane Bateman, The First aid companion for dogs & cats published by Rodale books, 2001.
2. Alan Edwards, The ultimate Encyclopedia of cats, cat breeds & cat care; published by south water, 2012.

Reference Books:

3. Sheldon L. Gerstenfeld, V.M.D, The Bird Care Book, published by Da Capo Lifelong books, 1989.
4. David E. Boruchowitz, The simple Guide to freshwater Aquariums, published By TFH publications, inc. 2001.
5. Gary A Gallerstein, D.V.M . The complete Pet Bird owner's Handbook published by Avian Publications, 2003.

E-Resources:

www.bluecrossofindia.org
www.peta.org
https://www.britannica.com/animal/pet

SEMESTER I

PIZOB20 - INDEPENDENT ELECTIVE I B- BIOPHYSICS

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	I	PIZOB20	Biophysics	Theory	Independent Elective	-	2	100

Objectives:

- To impart knowledge on the basic principles of biophysics.
- To employ different advanced Methodologies in Research.

Course Outcomes:

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

CO1: Recall the basic concepts of Biophysics.

CO2: Describe and apply the law of thermodynamics of the biological system and concepts of energy

CO3: Explain the membrane conductivity and transport.

CO4: Explain the principle techniques and application of lasers in biomedical field.

CO5: Discuss the working principle, instrumentation and applications of bio-analytical instruments.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	L	H	M	H
CO2	H	H	M	H	L	H
CO3	H	H	H	H	L	H
CO4	H	H	M	H	M	H
CO5	H	H	M	H	M	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	L	M
CO2	H	H	H	L	M	H
CO3	H	H	H	M	L	M
CO4	H	H	M	H	M	H
CO5	H	H	H	M	L	H

Unit 1:

1.1: Basic concepts of biophysics- Atoms, Atoms and elements. (K1, K2, K3, K4, K5)

1.2: Molecules and components. (K1, K2, K3, K4, K5)

1.3: Structure of atoms, isotopes, hydrogen ion concentration. (K1, K2, K3, K4, K5)

1.4: Mole and mole concept. (K1, K2, K3, K4, K5)

1.5: Normality, buffers, stability. (K1, K2, K3, K4, K5)

1.6: Redox potential and examples of redox potential in biological systems. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Thermodynamics of biological system- first and second law of thermodynamics. (K1, K2, K3, K4, K5)

2.2: Activation energy biological system as open non equilibrium system. (K1, K2, K3, K4, K5)

2.3: Concepts of energy unavailable energy. (K1, K2, K3, K4, K5)

2.4: Entropy. (K1, K2, K3, K4, K5)

2.5: Enthalpy, Negative entropy. (K1, K2, K3, K4, K5)

2.6: Application of biological system thermodynamics of active and passive transport. (K1, K2, K3, K4, K5)

Unit 3:

3.1: Membrane conductivity- active transport mechanism. (K1, K2, K3, K4, K5)

3.2: Factors-biological significance- characterization. (K1, K2, K3, K4, K5)

3.3: Biological importance. (K1, K2, K3, K4, K5)

3.4: Techniques used in diffusion, Osmosis, emulsions. (K1, K2, K3, K4, K5)

3.5: Colloids, dialysis. (K1, K2, K3, K4, K5)

3.6: Velocity and surface tension. (K1, K2, K3, K4, K5)

Unit 4:

4.1: Principle and application of sensors. (K1, K2, K3, K4, K5)

4.2: Laser beam in Biomedical field –applications of Lasers in therapies and diagnosis. (K1, K2, K3, K4, K5)

4.3: Magnetic Resonance Imaging (MRI), Computer Topography (CT)scan. (K1, K2, K3, K4, K5)

4.4: Ultrasound in interaction with tissues and application in therapeutics. Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyograph (EMG). (K1, K2, K3, K4, K5)

4.5: Flow Cytometry and cell sorting. (K1, K2, K3, K4, K5)

4.6: Autoradiography –types and techniques used and Evaluation of radiogram. (K1, K2, K3, K4, K5)

Unit 5:

5.1: Chromatography-Adsorption, Partition, Principle, Experimental set up, Methodology and Applications of Gel-Permeation Chromatography. (K1, K2, K3, K4, K5)

5.2: Gas Liquid Chromatography. (K1, K2, K3, K4, K5)

5.3: Electrophoresis principle, factors affecting the migration of substances and supporting media immune electrophoresis. (K1, K2, K3, K4, K5)

5.4: Slab Gel electrophoresis. (K1, K2, K3, K4, K5)

5.5: Spectroscopy –Atomic Emission Spectroscopy, Atomic Absorption Spectroscopy. (K1, K2, K3, K4, K5)

5.6: Electron Spin Spectroscopy. (K1, K2, K3, K4, K5)

Books for Study and Reference

Textbooks:

1. D.A Skoog et.,al Principles of Instrumental Analysis., 5th edition Saunders College Publication,1998.
2. Daniel .M Basic Biophysics for Biologist Agro Botanical Publishers India 1989.

Reference Books:

3. De Robertis E.D.P and De Robertis E.M.F Cell and Molecular biology VIII Edition Lippincott Williams and Wilkins Philadelphia 2006.
4. Khandpur,R S Handbook of Biomedical Instrumentation, McGraw Hill Publishing Co.Ltd.2003.
5. Kudesia V.P., Sawhey S.S Instrumental Method of Chemical Analysis Pragathi Prakashan Meerut.
6. Palanichamy S and Shunmugavelu M Principles of Biophysics Palani Paramount Publication 1996.
7. Subramanian M A Biophysics Principles and Techniques MJP Publishers Chennai.
8. Thiravia Raj Biophysics Biophysics Saras Publication 1995.
9. Vatsala Piramal Biophysics Dominant Publishers and Distributors 2006.

E-Resources:

https://bioeng.berkeley.edu
https://www.vanderbilt.edu
https://worldwidescience.org

SEMESTER II

PIZOC20 - INDEPENDENT ELECTIVE II A-ANIMAL HUSBANDARY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	II	PIZOC20	Animal Husbandry	Theory	Independent Elective	-	2	100

Objectives of the paper

- To know about the care and management of livestock.
- To learn the correct method of feeding, breeding, housing and health care of livestock.

Course Outcomes:

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

CO1: Explain the management of livestock.

CO2: Expand the knowledge to differentiate special breeds of cattle.

CO3: Elucidate different methods of breeding.

CO4: Summarize on the nutritive feeding practice of cattle.

CO5: Provide intensive ideas on management of cattle.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	M	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	M	H	H	H	H

Unit 1: Cattle Industry In South India

1.1: Cattle – importance, classification. (K1, K2, K3, K4, K5)

1.2: Population and food supply, suitable environment, rainfall and soil. (K1, K2, K3, K4, K5)

1.3: Suitability for tracts and farming types. (K1, K2, K3, K4, K5)

1.4: Grazing conditions, communal, fore stand private grazing. (K1, K2, K3, K4, K5)

1.5: Fodder cultivation. (K1, K2, K3, K4, K5)

1.6: Cattle rearing. (K1, K2, K3, K4, K5)

Unit 2: Important Breeds of Cattle In South India

2.1: Breed characters: Kangayam, Ogole. (K1, K2, K3, K4, K5)
2.2: Mysore and Alambadi breeds. (K1, K2, K3, K4, K5)
2.3: Barghur cattle, jellicut animals. (K1, K2, K3, K4, K5)
2.4: Tanjore polled cattle. (K1, K2, K3, K4, K5)
2.5: Buffaloes. (K1, K2, K3, K4, K5)
2.6: South Indian Breeds. (K1, K2, K3, K4, K5)

Unit 3: Methods of Breeding

3.1: In – breeding, line – breeding. (K1, K2, K3, K4, K5)
3.2: Out – crossing with other species and breeds. (K1, K2, K3, K4, K5)
3.3: Grading – up, selection – individuality. (K1, K2, K3, K4, K5)
3.4: Parentage, offspring influence. (K1, K2, K3, K4, K5)
3.5: Improvement of cattle in South India. (K1, K2, K3, K4, K5)
3.6: Hurdles in grading – up. (K1, K2, K3, K4, K5)

Unit 4: Principles of Feeding

4.1: Use of food, nutrients, nutritive ratio. (K1, K2, K3, K4, K5)
4.2: Starch equivalent, energy value, feeding standard. (K1, K2, K3, K4, K5)
4.3: Rations, roughages and concentrates. (K1, K2, K3, K4, K5)
4.4: Schedule of rations, some feeding hints. (K1, K2, K3, K4, K5)
4.5: Composition of feeding stuffs. (K1, K2, K3, K4, K5)
4.6: Digestibility coefficient of important feeds. (K1, K2, K3, K4, K5)

Unit 5: Management of Cattle

5.1: Housing, providing drinking water. (K1, K2, K3, K4, K5)
5.2: Grooming and washing. (K1, K2, K3, K4, K5)
5.3: Providing exercise. (K1, K2, K3, K4, K5)
5.4: Care of sick animals. (K1, K2, K3, K4, K5)
5.5: Vaccination. (K1, K2, K3, K4, K5)
5.6: Training young stock. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Animal Husbandry Department, Madras, Administration report for the year 1949 – 50.
2. Ind. Council of Agric., Res., New Delhi, Survey of cattle breeds in India, Bull., 24 (1934), 27 (1939) and 54 (1942).

Reference Books:

3. Kellner, C., The Scientific Feeding of Animals.
4. Maaynard, L.A., Animal Nutrition. Newyork, McGraw- Hill Book Company, 1947.
5. Pincher. C., The Breeding of farm Animals. Penguin Books, Ltd., Great Britain, 1946.
6. Sen. K.C., Cattle "Nutritive Value of Indian Feeds", ICAR Miscellaneous Bull., No.23 (1952).

E-Resources:
https://www.oercommons.org
https://www.dairyglobal.net
https://www.farmingindia.in/dairy-farming

SEMESTER II

PIZOD20 - INDEPENDENT ELECTIVE II B- ECO ENERGETICS AND ECOLOGICAL METHODS

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
I	II	PIZOD20	Eco Energetics And Ecological Methods	Theory	Independent Elective	-	2	100

Objectives:

- To promote environment, friendly, socially and sustainable model of energy
- To promote the concept of energy efficiency
- To understand the soil population estimation by using techniques
- To understand the methods of wildlife population estimation
- To gain the knowledge about zooplankton and phytoplankton.

Course Outcomes:

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

CO1: Explain the structure and functions of ecosystem.

CO2: Discuss the productivity and methods of measuring productivity.

CO3: Summarize about sampling and extraction techniques.

CO4: Describe the methods of wild life population studies.

CO5: Categorize the planktons, method of collection, preservation and morphological identification.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	L	M
CO2	H	H	M	H	M	M
CO3	H	H	M	H	L	M
CO4	H	H	H	H	M	M
CO5	H	H	M	H	L	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	H	M	M
CO2	H	M	H	H	M	M
CO3	H	M	H	H	M	L
CO4	H	H	M	H	H	L
CO5	H	H	M	H	H	L

Unit 1:

1.1: Concept of ecosystem- Define terms -ecosystem, habitat, ecological niche. (K1, K2, K3, K4, K5)

1.2: Energy flow in an ecosystem – model of energy flow. (K1, K2, K3, K4, K5)

1.3: Food Chain-Types of food chains. (K1, K2, K3, K4, K5)

1.4: Food webs. (K1, K2, K3, K4, K5)

1.5: Efficiency of energy transfer between trophic levels, ecological pyramids. (K1, K2, K3, K4, K5)

1.6: Law of thermodynamics. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Productivity. (K1, K2, K3, K4, K5)
2.2: Primary productivity and Secondary productivity. (K1, K2, K3, K4, K5)
2.3: Fundamentals of productivity, aspects of productivity. (K1, K2, K3, K4, K5)
2.4: Productivity rate, ecological efficiency. (K1, K2, K3, K4, K5)
2.5: Methods of measurement - harvest method, oxygen method. (K1, K2, K3, K4, K5)
2.6: pH method, disappearance of raw materials. (K1, K2, K3, K4, K5)

Unit 3:

3.1: Population Estimates by Sampling. (K1, K2, K3, K4, K5)
3.2: Unit of Soil or Litter Habitat. (K1, K2, K3, K4, K5)
3.3: Extraction Techniques; Bulk staining. (K1, K2, K3, K4, K5)
3.4: Mechanical methods of extraction, Dry sieving, Wet sieving. (K1, K2, K3, K4, K5)
3.5: Soil arthropod collection- Tullgren funnel series. (K1, K2, K3, K4, K5)
3.6: Soil washing and flotation. (K1, K2, K3, K4, K5)

Unit 4:

4.1: Wildlife Population Estimates by Census and Distance Measuring Techniques. (K1, K2, K3, K4, K5)
4.2: Census methods. (K1, K2, K3, K4, K5)
4.3: Point and line survey methods. (K1, K2, K3, K4, K5)
4.4: Indices of abundance using transects. (K1, K2, K3, K4, K5)
4.5: Methods based on flushing. (K1, K2, K3, K4, K5)
4.6: Line transect methods: the Fourier series estimator, Point transects. (K1, K2, K3, K4, K5)

Unit 5:

5.1: Planktons- types, characters and ecology. (K1, K2, K3, K4, K5)
5.2: Phytoplankton-Marine. (K1, K2, K3, K4, K5)
5.3: Phytoplankton – Freshwater. (K1, K2, K3, K4, K5)
5.4: Method of Collection. (K1, K2, K3, K4, K5)
5.5: Preservation and morphological Identification of Marine Zooplankton. (K1, K2, K3, K4, K5)
5.6: Preservation and morphological Identification of fresh water zooplankton. (K1, K2, K3, K4, K5)

Books for Study and References:

Textbooks:

1. Dr. Verma and Dr. Agarwal Environmental Biology(principle of ecology).
2. Eugene P.Odum Fundamentals of ecology.

Reference Books:

3. P.B. Nagaraj- Basic Thermodynamics Paperback – 1 Jan 2005.
4. O.L. Lange P.S Nobel C.B Osmond and H. Ziegler Physiological plant ecology IV .
5. ODarryl I. MacKenzie, James D. Nichols, J. Andrew Royle , Kenneth H. Pollock, Larissa Bailey, James E. Hines- Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence 1st Edition 2015.
6. Arvind Kumar-Ecology of Plankton.
7. Giri Kattel - Zooplankton and phytoplankton – types characteristic and ecology 2011.

E-Resources:

http://www.enviroindia.net
http://aelsindia.com
http://environment-ecology.com

SEMESTER III

PIZOE20 - INDEPENDENT ELECTIVE III A- RADIATION BIOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PIZOE20	Radiation Biology	Theory	Independent Elective	-	2	100

Objective:

- To understand the radiation protection.
- To learn about the application of radiation in treatments.

Course Outcomes:

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

CO1: Apply the fundamentals of radiation biology.

CO2: Explain the effects of Radiation on DNA and its effects.

CO3: Analyze the radiation exposure and response.

CO4: Asses the role of radiation in carcinogenesis.

CO5: Explain radio therapy, protection and precaution in using radioisotopes.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	L	M
CO2	H	H	M	H	L	H
CO3	H	H	H	H	M	M
CO4	H	H	M	H	M	H
CO5	H	H	H	H	M	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	L	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	M
CO4	H	H	H	H	M	H
CO5	H	H	M	H	M	M

Unit 1:

1.1: Definition, scope and significance of radiation biology. (K1, K2, K3, K4, K5)

1.2: General classification of radiation. (K1, K2, K3, K4, K5)

1.3: Ionizing radiation, linear energy transfer. (K1, K2, K3, K4, K5)

1.4: Radiation dose and units. (K1, K2, K3, K4, K5)

1.5: Principles of radiation dosimetry. (K1, K2, K3, K4, K5)

1.6: Direct and indirect effects. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Radiations lesions in DNA, radiobiological effect on cell. (K1, K2, K3, K4, K5)

2.2: Radiation sensitizers and protectors. (K1, K2, K3, K4, K5)

2.3: Effect of Radiation on Human Health. (K1, K2, K3, K4, K5)
2.4: Long term radiation risks from low radiations doses. (K1, K2, K3, K4, K5)
2.5: Radiation induced cancer. (K1, K2, K3, K4, K5)
2.6: Radiation effects in the developing embryo and fetus, radiation induced heritable diseases. (K1, K2, K3, K4, K5)

Unit 3:
3.1: Radiation Quantities Exposure, Absorbed Dose. (K1, K2, K3, K4, K5)
3.2: Equivalent Dose, Effective Dose. (K1, K2, K3, K4, K5)
3.3: Cellular Response To Radiation Indirect and direct action. (K1, K2, K3, K4, K5)
3.4: Time scale of radiation effects. (K1, K2, K3, K4, K5)
3.5: DNA damage and chromosomal aberrations. (K1, K2, K3, K4, K5)
3.6: Radioprotectors and Radiosensitizers. (K1, K2, K3, K4, K5)

Unit 4:
4.1: Time-scale of effects in Radiation Biology. (K1, K2, K3, K4, K5)
4.2: Response of normal and malignant tissues to radiation exposure. (K1, K2, K3, K4, K5)
4.3: Radiation Carcinogenesis. (K1, K2, K3, K4, K5)
4.4: Risk estimates for radiation-induced cancer. (K1, K2, K3, K4, K5)
4.5: Radiation-induced sterility. (K1, K2, K3, K4, K5)
4.6: Hereditary effects of radiation. (K1, K2, K3, K4, K5)

Unit 5:
5.1: Whole-Body Radiation Effects Acute radiation syndrome. (K1, K2, K3, K4, K5)
5.2: Treatment of radiation accident victims. (K1, K2, K3, K4, K5)
5.3: Radiation Protection. (K1, K2, K3, K4, K5)
5.4: Radio therapy. (K1, K2, K3, K4, K5)
5.5: Risk estimates in Humans. (K1, K2, K3, K4, K5)
5.6: Precautions and safety measures in handling radioisotopes. (K1, K2, K3, K4, K5)

Books for Study and reference:

Textbooks:
1. Physics and Radiobiology of Nuclear Medicine - Gopal B. Saha. – Springer IIIrdedition 2006. 2. Radiation and Man - H. C. Jain - National Book trust, India. – 1994.

Reference Books:
3. Essentials of Radiation Biology and Protection – Steve Forshier II nd edition 2. Life Sciences and Radiation – J. Kiefer - Springer 2004.
4. An Introduction to Radiobiology, 2nd edition (1998), A. H. W. Nias, Wiley Blackwell, ISBN13: 978-0471975908.
5. Radiation Biology 3.1. Fliedner, T. M., Friesecke, I. & Beyrer, K., 2001.

6. Medical management of radiation accidents– manual on the acute radiation syndrome.British Institute of Radiology Supplement.
7. Hall, E. J, Giaccia A. J. 2006. Radiobiology for the radiologist, Philadelphia, Pa: Lippincott Williams & Wilkins.
8. INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, 2006: Low dose extrapolation of radiation-related cancer risk, ICRP publication.

E-Resources:

https://www.utoledo.edu
https://www.ncbi.nlm.nih.gov
https://www.astro.org

SEMESTER III

PIZOF20 - INDEPENDENT ELECTIVE III B- DAIRYING.

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	III	PIZOF20	Dairying	Theory	Independent Elective	-	2	100

Objective:

- To learn the techniques in improved milk production.
- To know the preservation and processing of milk.

Course Outcomes:

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

CO1: Discuss the development and management of dairying.

CO2: Explain properties of milk and its composition.

CO3: Describe various periods of milking, variations in compositions and equipments used in milking.

CO4: Discuss entry of bacteria into milk and types of bacteria.

CO5: Explain various methods of pasteurization.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	H	H	M
CO2	H	H	M	H	H	M
CO3	H	H	M	H	H	M
CO4	H	H	M	H	H	M
CO5	H	H	M	H	H	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	H	M	H
CO2	H	H	M	H	M	H
CO3	H	H	M	H	M	H
CO4	H	H	M	H	M	H
CO5	H	H	M	H	M	H

Unit 1:

1.1: Development of dairying. (K1, K2, K3, K4, K5)

1.2: Cattle population and production of milk. (K1, K2, K3, K4, K5)

1.3: Dietary requirements of milk, milk intake and income levels. (K1, K2, K3, K4, K5)

1.4: Milk production-cost relationship. (K1, K2, K3, K4, K5)

1.5: Utilisation of milk. (K1, K2, K3, K4, K5)

1.6: Nutritive value of milk. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Lactation, milk as food. (K1, K2, K3, K4, K5)
2.2: Udder, secretion of milk, let-down of milk. (K1, K2, K3, K4, K5)
2.3: Factors affecting secretion-individuality, feeding, environment and maintenance. (K1, K2, K3, K4, K5)
2.4: Properties of milk. (K1, K2, K3, K4, K5)
2.5: Composition of milk-proteins, fat, lactose, ash and water, vitamins. (K1, K2, K3, K4, K5)
2.6: Thermal stability of milk. (K1, K2, K3, K4, K5)

Unit3:
3.1: Variations in composition-period preceding milking. (K1, K2, K3, K4, K5)
3.2: Time of milking, portion of milk tested. (K1, K2, K3, K4, K5)
3.3: Stage of lactation, age of cow, and feed. (K1, K2, K3, K4, K5)
3.4: Food value of milk. (K1, K2, K3, K4, K5)
3.5: Enzymes in milk. (K1, K2, K3, K4, K5)
3.6: Colostrum pre-milking, slimy or ropy milk. (K1, K2, K3, K4, K5)

Unit 4:
4.1: Entry of bacteria into milk, water-supply, attendants. (K1, K2, K3, K4, K5)
4.2: Unhealthy animals; types of bacteria in milk. (K1, K2, K3, K4, K5)
4.3: Effects of bacteria on milk; reducing number of bacteria in milk. (K1, K2, K3, K4, K5)
4.4: Milk borne diseases. (K1, K2, K3, K4, K5)
4.5: Dairy utensils, cleaning. (K1, K2, K3, K4, K5)
4.6: Sterilising utensils and equipment. (K1, K2, K3, K4, K5)

Unit 5:
5.1: Pasteurisation of milk in India. (K1, K2, K3, K4, K5)
5.2: Holder method of pasteurisation. (K1, K2, K3, K4, K5)
5.3: H.T.S.T. method, pasteurising bottled milk. (K1, K2, K3, K4, K5)
5.4: Cooling after pasteurisation. (K1, K2, K3, K4, K5)
5.5: Homogenisation, grading milk. (K1, K2, K3, K4, K5)
5.6: Packing of milk(K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:
1. The technology of milk Proceesing – Ananthakrishnan, C.P., Khan, A.Q. and Padmanabhan, P.N. – Shri Lakshmi Publications.
2. Dastur, N. N. and Banerji, B. N Manufacture and Storage of Ghee. Ind. FarminR, IX (7), pp. 78. 1948.

Reference Books:

3. International lnst. of Agric., Rome, Dairy Cow Testing throughout the World, 1938.
4. Owe, L. T. and Goldie, J. M., The Student's Handbook of Milk and Milk Products. Worcestershire, Little bury and Company, 1947.
5. HL Rangappa, K. S. and Achayya, K. T., Chemistry and Manufacture of Indian Dairy Products. The Bangalore Printjng and Publishing Co., Ltd., Bangalore, 1948.
6. Report on the Marketing of Milk in the Indian Union, lndia Government Publication, New Delhi, 1950.

E-Resources:

http://www.asci-india.com
https://dgt.gov.in
http://www.dahd.nic.in

SEMESTER IV

PIZOG20 - INDEPENDENT ELECTIVE IVA- BIOSYSTEMATICS

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	IV	PIZOG20	Biosystematics	Theory	Independent Elective	-	2	100

Objectives:

- To understand biological characteristics.
- To learn diversity and evolutionary relationship among the organisms.
- To apply phylogeny classification at species level and infra species level.

Course Outcomes:

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

CO1: Explain the concept, importance and attributes of biosystematics.

CO2: Discuss the biological characteristics.

CO3: Compute the evolutionary relationship among the organisms.

CO4: Familiarize different taxonomic procedures, taxonomic keys and zoological nomenclature.

CO5: Apply phylogeny classification at species level and infra species level.

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	M
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	M	H	H	H	H

CO/PLO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

Unit 1:

1.1: Introduction & basic concept of biosystematics & taxonomy. (K1, K2, K3, K4, K5)

1.2: Rise of Taxonomy - Problems, aims and tasks in taxonomy. (K1, K2, K3, K4, K5)

1.3: Taxonomy as a profession. (K1, K2, K3, K4, K5)

1.4: Importance & application of biosystematics in biology. (K1, K2, K3, K4, K5)

1.5: Chemotaxonomy – Cytotaxonomy. (K1, K2, K3, K4, K5)

1.6: Attributes of Taxonomy. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Types of biological classification (Essentialism, Nominalism, Empirism, Cladism and evolutionary classification). (K1, K2, K3, K4, K5)

2.2: Newer Trends in Taxonomy: Morphological approach, Immature stages and embryological approach. (K1, K2, K3, K4, K5)

2.3: Ecological Approach, Behavioural Approach. (K1, K2, K3, K4, K5)

2.4: Cytological and Biochemical Approaches. (K1, K2, K3, K4, K5)

2.5: Numerical taxonomy. (K1, K2, K3, K4, K5)

2.6: Differential Systematics. (K1, K2, K3, K4, K5)

Unit 3:

3.1: Zoological Classification Kinds of classification, phyletic lineages. (K1, K2, K3, K4, K5)

3.2: Components of classification - Hierarchy of categories. (K1, K2, K3, K4, K5)

3.3: Species concepts, Typological species concept, Nominalistic species concept. (K1, K2, K3, K4, K5)

3.4: Biological species concept, Evolutionary species concept, Recognition species concept. (K1, K2, K3, K4, K5)

3.5: Kinds of species : Polytypic & monotypic species, subspecies, infraspecific groups. (K1, K2, K3, K4, K5)

3.6: Super species, other kind of species. (K1, K2, K3, K4, K5)

Unit 4:

4.1: Taxonomic procedures, Taxonomic collection. (K1, K2, K3, K4, K5)

4.2: Curetting of animals & Process of Identification. (K1, K2, K3, K4, K5)

4.3: Preservation of specimens. (K1, K2, K3, K4, K5)

4.4: Taxonomic Keys - Types, merits & demerits. (K1, K2, K3, K4, K5)

4.5: International code of Zoological Nomenclature (ICZN). (K1, K2, K3, K4, K5)

4.6: Interpretation of rules of nomenclature. (K1, K2, K3, K4, K5)

Unit 5:

5.1: Taxonomic Records. (K1, K2, K3, K4, K5)

5.2: Publications Taxonomic keys. (K1, K2, K3, K4, K5)

5.3: Taxonomic characters description. (K1, K2, K3, K4, K5)

5.4: Taxonomic paper. (K1, K2, K3, K4, K5)

5.5: Zoological Records. (K1, K2, K3, K4, K5)

5.6: Directories, Abstracts, Review. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Kapoor V.C. 2010. Theory and practice of animal taxonomy, Oxford and IBH, New Delhi.
2. Ashok Verma, 2015. Principles of Animal Taxonomy, Narosa Publishing house, New Delhi.

Reference Books:

3. George Gaylord Simpson, 1990. Principles of animal taxonomy, Columbia University Press, New York.
4. Quicke, D. L. J, 2008. Principles and Techniques of contemporary Taxonomy, Blackie Academic Professional, 310pp.
5. Quentin. T. Wheeler,2008m The New Taxonomy, The Systematics Association Special Volume Series, 76. (ed.) CPR Press.
6. Theodore Horace Savory, 1970. Animal Taxonomy, University of Michigan.
7. Dr.R.C.Tripathi, Biosystematics & Taxonomymm, University Book House, Jaipur.
8. G.G. Simpson, Principle of Animal Taxonomy**:** Oxford & IBH Publishing Co.

E-Resources:

http://epgp.inflibnet.ac.in
https://onlinelibrary.wiley.com
http://www.brainkart.com

SEMESTER IV

PIZOH20 - INDEPENDENT ELECTIVE IV B - GENERAL PSYCHOLOGY

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II	IV	PIZOH20	General Psychology	Theory	Independent Elective	-	2	100

Objectives:

- To understand, predict and control behavior.
- To learn the causes of abnormal behavior.
- To minimize the intensity of real-life problems

Course Outcomes:

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

CO1: Explain Psychology and its branches.

CO2: Define concept of self and describe the theories of Personality.

CO3: Discuss the need of social psychology.

CO4: Explain Psychopathology.

CO5: Apply the knowledge of psychology in different areas like forensic, family, court etc.

CO/PSO	PSO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	M	M	H	M	M
CO2	L	M	H	H	H	M
CO3	L	M	H	M	H	H
CO4	L	M	M	H	M	M
CO5	L	M	M	H	H	M

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	M	M	H	H
CO2	H	M	M	H	H	H
CO3	H	H	H	M	H	H
CO4	H	H	H	M	M	H
CO5	H	H	M	M	H	H

Unit 1:

1.1: Psychology -Meaning- Scope. (K1, K2, K3, K4, K5)

1.2: Branches. (K1, K2, K3, K4, K5)

1.3: Application of Psychology in Family. (K1, K2, K3, K4, K5)

1.4: Education, Health, Self-Development. (K1, K2, K3, K4, K5)

1.5: Research in Psychology, Research challenges. (K1, K2, K3, K4, K5)

1.6: States of Consciousness.

Unit 2:

2.1: The Concept of Self. (K1, K2, K3, K4, K5)
2.2: Personality – Definition- Structure of personality. (K1, K2, K3, K4, K5)
2.3: Dynamic Nature of Personality. (K1, K2, K3, K4, K5)
2.4: Personality development- Theories of Personality. (K1, K2, K3, K4, K5)
2.5: Psychoanalytic method. (K1, K2, K3, K4, K5)
2.6: Personality Evaluation. (K1, K2, K3, K4, K5)

Unit 3:

3.1: Social Psychology – Aim – Scope- Methods. (K1, K2, K3, K4, K5)
3.2: Nature and Need of Social Behavior. (K1, K2, K3, K4, K5)
3.3: Sequence of social development- Infancy, Childhood. (K1, K2, K3, K4, K5)
3.4: Social maturity, Social Norm. (K1, K2, K3, K4, K5)
3.5: Role and Status- Social Interaction. (K1, K2, K3, K4, K5)
3.6: Socialization. (K1, K2, K3, K4, K5)

Unit 4:

4.1: Psychopathology- Abnormal behavior. (K1, K2, K3, K4, K5)
4.2: Models- Diagnosing and Classifying disorders. (K1, K2, K3, K4, K5)
4.3: Neuroses- Psychoses- Schizophrenia. (K1, K2, K3, K4, K5)
4.4: Personality disorders. (K1, K2, K3, K4, K5)
4.5: Prevalence of Mental disorders. (K1, K2, K3, K4, K5)
4.6: Anxiety Disorder. (K1, K2, K3, K4, K5)

Unit 5:

5.1: Forensic Psychology- Family Court- Civil Court- Criminal Court. (K1, K2, K3, K4, K5)
5.2: Child Abuse Evaluations, Termination of parental rights. (K1, K2, K3, K4, K5)
5.3: Adoption Readiness Evaluation. (K1, K2, K3, K4, K5)
5.4: Personal Injury Evaluations. (K1, K2, K3, K4, K5)
5.5: Psychological factors in physical trauma, Sexual Harassment. (K1, K2, K3, K4, K5)
5.6: Alcohol Abuse and Drug Abuse. (K1, K2, K3, K4, K5)

Books for Study and References:

Textbooks:

1. Ernest R Hilgard, Richard C Atkinson and Rita L Atkinson – Introduction to Psychology 6th Edition- Oxford & IBH Publishing Co. Pvt. Ltd. 1975
2. Chaube S.P. Social Psychology- Second Revised Edition- Lakshmi Narain Agarwal Educational Publishers, Agra- 3. 1995.

Reference Books:

3. Robert S. Feldman – Psychology and Your Life - Tata McGraw Hill Education Pvt. Ltd. New Delhi- 2012
4. Lester D Crow and Alice Crow- Child Development and Adjustment- Surjeet Publication- 2008
5. Saundra K Ciccarelli, Noland White J. – Psychology- Pearson 5th Ed. 2017
6. Kaila H. L. – Introduction to Psychology – AITBS Publishers- India 2008.

E-Resources:

https://ocw.mit.edu
https://libguides.humboldt.edu
https://www.oercommons.org

SEMESTER IV

PIZOI20 - INDEPENDENT ELECTIVE IVC- ANIMAL CARE

Year	SEM	Course code	Title of the Course	Course Type	Course Category	H/ W	Credits	Marks
II	IV	PIZOI20	Animal Care	Theory	Independent Elective	-	2	100

Objective

- To impart special knowledge on animals and their relationship.
- To learn to examine sick animals, and understand how diagnostic procedures are applied for determining diseases.
- To learn about animal psychology; innate behaviour and survival.

Course Outcomes:

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

CO1: Exapand knowledge on animal feeding.

CO2: Acquire knowledge on requirements for animal accommodation.

CO3: Recognize sick animals and diagnostic procedures to determine the disease.

CO4: Apply their knowledge in handling, restraining and transporting animals.

CO5: Explain animal psychology, innate behavior and survival.

CO/PO	PO					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PO	PO					
	PO1	PO2	PO3	PO4	PO5	PLO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

Unit 1:

1.1: Animal Care- Scope. (K1, K2, K3, K4, K5)

1.2: Animal feeding: Types of feeder. (K1, K2, K3, K4, K5)

1.3: Nutritional requirements; vitamins, minerals. (K1, K2, K3, K4, K5)

1.4: Choosing and preparing food. (K1, K2, K3, K4, K5)

1.5: Quantity and timing of feeding. (K1, K2, K3, K4, K5)

1.6: Supplements. (K1, K2, K3, K4, K5)

Unit 2:

2.1: Animal accommodation. (K1, K2, K3, K4, K5)
2.2: Housing requirements. (K1, K2, K3, K4, K5)
2.3: Bedding materials. (K1, K2, K3, K4, K5)
2.4: Fixtures and fittings. (K1, K2, K3, K4, K5)
2.5: Cleaning and maintaining. (K1, K2, K3, K4, K5)
2.6: Waste disposal. (K1, K2, K3, K4, K5)

Unit 3:

3.1: Animal health: Disease prevention. (K1, K2, K3, K4, K5)
3.2: Common diseases of dogs, cats and rabbits. (K1, K2, K3, K4, K5)
3.3: Endoparasites and ectoparasites. (K1, K2, K3, K4, K5)
3.4: Signs of ill health. (K1, K2, K3, K4, K5)
3.5: First aid procedures. (K1, K2, K3, K4, K5)
3.6: Remedies. (K1, K2, K3, K4, K5)

Unit 4:

4.1: Handling, restraining and moving animals. (K1, K2, K3, K4, K5)
4.2: Need for handle, restrain and move animals. (K1, K2, K3, K4, K5)
4.3: Personal protective equipment. (K1, K2, K3, K4, K5)
4.4: Handling equipment. (K1, K2, K3, K4, K5)
4.5: Restraint equipment. (K1, K2, K3, K4, K5)
4.6: Reducing stress. (K1, K2, K3, K4, K5)

Unit 5:

5.1: Animal behaviour; Normal behaviour; Emotions. (K1, K2, K3, K4, K5)
5.2: Abnormal behaviour. (K1, K2, K3, K4, K5)
5.3: Stereotypic behaviour. (K1, K2, K3, K4, K5)
5.4: Observing behaviour; methods and recording. (K1, K2, K3, K4, K5)
5.5: Avoiding/ reducing abnormal behaviour. (K1, K2, K3, K4, K5)
5.6: Environmental enrichment. (K1, K2, K3, K4, K5)

Books for Study and Reference:

Textbooks:

1. Staff of ACS distance education. Animal feed and nutrition- ISBN NO: 979-0-9942948.
2. Dr. Pitcarins complete guide to natural health for dogs and cat. Published by Rodale books 2005.

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1. Carol Ekarius -Animal housing
2. Julie Massoni, Health pets naturally published in 2014
3. Martin Goldstein, The Nature of Animal Healing. Published by Ballantine books, 1999.
4. D. Broom, Domestic animal behavior and welfare published by CABI, 2007.

E-Resources:

https://olaw.nih.gov
https://www.academia.edu
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