



Deccan Education Society's

FERGUSSON COLLEGE (AUTONOMOUS)PUNE-4

**SYLLABUS
M.Sc. ZOOLOGY**

Academic Year 2022-2023

SEMESTER – III & IV

Programme Structure

Sem.	Course Code	Course Title	Course	No.of credits
I	ZOO4101	Comparative Anatomy of Vertebrates	T-Core-1	04
	ZOO4102	Cell Biology	T-Core-2	04
	ZOO4103	Biochemistry	T-Core-3	04
	ZOO4104	Zoology Practical-I	P-Core-1	04
	ZOO4105	Zoology Practical-II	P-Core-2	04
	ZOO4106	Animal Behavior	Elective-1	04
	ZOO4107	MOOCs to be selected by students		04
	ZOO4108	Advanced Endocrinology		04
			Total Credit	
II	ZOO4201	Comparative Physiology of Vertebrates	T-Core-4	04
	ZOO4202	Genetics	T-Core-5	04
	ZOO4203	Developmental Biology	T-Core-6	04
	ZOO4204	Zoology Practical-III	P- Core-3	04
	ZOO4205	Zoology Practical-IV	P-Core -4	04
	ZOO4206	Immunology	Elective-2	04
	ZOO4207	MOOCs to be selected by students		04
	ZOO4208	Environmental Biology		04
			Total Credit	
III	ZOO5301	Evolutionary Biology	T-Core-7	04
	ZOO5302	Molecular Biology	T-Core-8	04
	ZOO5303	Advanced Biostatistics	T-Core-9	04
	ZOO5304	Zoology Practical-V	P-Core-5	04
	ZOO5305	Zoology Practical-VI	P-Core-6	04
	ZOO5306	Skills in Scientific communication and writing	Elective-3	04
	ZOO5307	MOOCs to be selected by students		04
	ZOO5308	Histology and Histo -chemistry		04
			Total Credits	
IV	ZOO5401	Project work and Dissertation/ Summer Training / Institutional trainings	P-Special-1	08
		OR		
	ZOO5401	MOOCs to be selected by students	M-Special-1	08
		Total Credits		(08)
		Total Credits Of The Course		80

Program Outcomes (POs) for M.Sc Programme	
PO1	Disciplinary Knowledge: Demonstrate comprehensive knowledge of the discipline that form a part of an postgraduate Programme. Execute strong theoretical and practical understanding generated from the specific Programme in the area of work.
PO2	Critical Thinking and Problem solving: Exhibit the skill of critical thinking and understand scientific texts and place scientific statements and themes in contexts and also evaluate them in terms of generic conventions. Identify the problem by observing the situation closely, take actions and apply lateral thinking and analytical skills to design the solutions.
PO3	Social competence: Exhibit thoughts and ideas effectively in writing and orally; communicate with others using appropriate media, build effective interactive and presenting skills to meet global competencies. Elicit views of others, present complex information in a clear and concise and help reach conclusion in group settings.
PO4	Research-related skills and Scientific temper: Infer scientific literature, build sense of enquiry and able to formulate, test, analyse, interpret and establish hypothesis and research questions; and to identify and consult relevant sources to find answers. Plan and write a research paper/project while emphasizing on academics and research ethics, scientific conduct and creating awareness about intellectual property rights and issues of plagiarism.
PO5	Trans-disciplinary knowledge: Create new conceptual, theoretical and methodological understanding that integrates and transcends beyond discipline-specific approaches to address a common problem.
PO6	Personal and professional competence: Perform independently and also collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	Effective Citizenship and Ethics: Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	Environment and Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	Self-directed and Life-long learning: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Programme Specific Outcomes for PG Zoology:	
PSO1	<p>Academic Competence:</p> <ul style="list-style-type: none"> (i) Describe fundamental concepts, principles and processes underlying the life science its different disciplines. (ii) Understand the evolutionary, genetical, molecular, histological, and behavioral context of biological thought and research, and the contributions of physiological, anatomical, immunological and cellular studies of animals, to the resolution of medical, social and environmental issues even at molecular level. (iii) Demonstrate a wide range of biochemical techniques, physiological processes, cellular activities, developmental and evolutionary processes, statistical methods and bioinformatics.
PSO2	<p>Personal and Professional competence:</p> <ul style="list-style-type: none"> (i) Demonstrate the competence in fundamental zoological skills/techniques and experimentation using various methods in animal models and their behavior, cell and molecular biology, biochemistry, developmental biology and immunology. (ii) Illustrate methods in evolutionary biology, environmental science, biostatistics and bioinformatics and analyses biological data statistically. (iii) Formulation of ideas, scientific writing and authentic reporting, effective presentation and communication skills .
PSO3	<p>Research Competence:</p> <ul style="list-style-type: none"> (i) Analyze and interpret results obtained in cell biology, molecular biology, biochemistry, genetics, developmental biology, immunology, histology. (ii) Create biological data and skills to explore and authenticate data for experimental and research purpose.
PSO4	<p>Entrepreneurial and Social competence:</p> <ul style="list-style-type: none"> (i) Evaluate data of the societal relevance of biological systems and the processes and apply the knowledge of zoology in the different fields to address problems related to human kind. (ii) Collaborate in various zoological services with demonstration of true values of leadership, co-operation, hard work, teamwork etc. during the field works, surveys and field visits.

S.Y M.Sc. (Zoology) Semester III		
Title of the Course and Course Code	Evolutionary Biology ZOO5301	Number of Credits -4
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe concept and salient features of evolution, polymorphism, natural Selection and genetic drift.	
CO2	Explain working of natural selection, theory of genetic drift gene flow, origin of Polymorphism and biological evolution	
CO3	Illustrate genetic basis of genetic drift, different mechanisms to maintain polymorphism within populations. Demonstration of role of natural selection, experimental verification of balanced polymorphism in evolutionary biology	
CO4	Differentiate r-selection and k-selection, founder effect and bottleneck phenomenon, balanced polymorphism and transient polymorphism and different theories of evolution.	
CO5	Review the results of natural selection, genetic basis of random genetic drift, persistence of variability and different evidences of evolution	
CO6	Write a report on natural selection in nature, genetic drifts in real populations, experimental verification of balanced polymorphism, Compile the knowledge of evolutionary biology to infer -Evolution-a fact or just a theory.	

Unit No.	Title and Contents	No. of Credits
I	<p>CONCEPT, EVIDENCES AND THEORIES OF EVOLUTION</p> <p>Concept of Evolution Evolution and Evolutionary Biology Definition of Biological Evolution Basic Concept of Organic Evolution Development of the Idea of Evolution Evolution-A Fact or Just a Theory</p>	1
II	<p>Persistence of Variability within Populations:</p> <p>Polymorphism Balanced Polymorphism Transient Polymorphism Origin of Polymorphism Mechanisms to Maintain Polymorphism within Populations - Internal Mechanisms, Cytogenetic Mechanism, Ecological Mechanism</p>	1
III	<p>Evolutionary Genetics</p> <p>Genetic Drift and Gene Flow Random Genetic Drift or Sewall Wright Effect Theories of Genetic Drift Salient Features of Genetic Drift Genetic Basis of Random Genetic Drift Genetic Drifts in Real Populations Founder Effect or Founder Principle ,Bottleneck Phenomenon</p>	1
IV	<p>Natural Selection in Action</p> <p>Concept, salient features and nature of Natural Selection Demonstration, working, components and Levels of Natural Selection The Results of Natural Selection Models of Selection, Frequency Dependent Selection Heterozygous Advantage or Heterosis Balancing Selection and Balanced Polymorphism r-Selection and k-Selection, Selection Pressure or Selection Intensity Selection and Reproduction, Selection and Mutations Selection and Variation, Selection and Adaptations (The Baldwin Effect)</p>	1

SUGGESTED READINGS

Classics

1. Darwin, C. 1859. *On the Origin of Species*. London: John Murray (always seek out the first edition, facsimile version, and avoid later editions).
2. Dobzhansky, T. 1937. *Genetics and the Origin of Species*. New York: Columbia Univ. Press (there are several later editions, and the title changed in the last).
3. Fisher, R. A. 1930. *The Genetical Theory of Natural Selection*. Oxford: Oxford Univ. Press (there is a later edition).
4. Hennig, W. 1966. *Phylogenetic Systematics*. Urbana: Univ. Illinois Press (an English translation of a book published earlier in German).
5. Mayr, E. 1942. *Systematics and the Origin of Species*. New York: Columbia Univ. Press (there is a later edition, with a different title).
6. Schmalhausen, I. I. 1949. *Factors of Evolution*. Philadelphia: Blakiston (publication of this book, written in the early 1940's, was delayed because of war, and then the translation from Russian to English was also delayed; it has been reprinted by Univ. Chicago Press).
7. Simpson, G. G. 1944. *Tempo and Mode of Evolution*. New York: Columbia Univ. Press (again, there is a later edition, with a different title).

General Books

8. Allendorf, F.w., and G. Luikart, 2007. *Conservation and the Genetics of Populations*. Blackwell, Oxford.
9. Crow, J. F. 1991. *Basic Concepts in Population, Quantitative, and Evolutionary Genetics*. New York: W. H. Freeman.
10. Falconer, D. S. 1981. *Introduction to Quantitative Genetics*, second ed. London: Longman.
11. Hartl, D. L. And A. G. Clark. 1989. *Principles of Population Genetics*, second, ed. Sunderland, MA: Sinauer.
12. Real, L. A. (ed.). 1994. *Ecological Genetics*. Princeton: Princeton Univ. Press (a collection of essays by many authors).
13. Hall, B. J. (ed.). 1994. *Homology, the Hierarchical Basis of Comparative Biology*. San Diego: Academic Press (a collection of essays by many authors).
14. Keller, E. F. and E. A. Lloyd. 1992. *Keywords in Evolutionary Biology*. Cambridge, MA: Harvard Univ. Press.
15. Mayr, E. 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance*. Cambridge, MA: Harvard Univ. Press.
16. *Evolution* by Mark Ridly © 2004 by Blackwell Science Ltd a Blackwell Publishing company
17. *Organic Evolution (Evolutionary Biology)* thirteenth edition By Veer Bala Rastogi publisher medtech a division of scientific international.

Online Readings:-

18. [Evolutionary principles and their practical application \(nih.gov\)](#)
19. [Biology and evolution of life science \(nih.gov\)](#)
21. [Evidence Supporting Biological Evolution - Science and Creationism - NCBI Bookshelf \(nih.gov\)](#)
22. [Selection of Models: Evolution and the Choice of Species for Translational Research - FullText - Brain, Behavior and Evolution 2019, Vol. 93, No. 2-3 - Karger Publishers](#)

S.Y. M.Sc. Semester III

Title of the Course and Course Code	Molecular Biology ZOO5302	Number of Credits : 04
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Describe the flow of genetic information. Illustrate genome organization Review the differences in genomes and life processes of prokaryotes and eukaryotes.	
CO2	Compare various Molecular Biology processes like replication, transcription, translation in prokaryotes and eukaryotes, its importance and regulation of replication, transcription and translation	
CO3	Illustrate different methods of DNA repair in prokaryotes and eukaryotes. Integrate the knowledge of different techniques in Molecular Biology such as Protein- DNA interaction in-vitro and in-vivo techniques.	
CO4	Outline concept of Plasmids, its importance and explain different types of Plasmids in Prokaryotes. Describe their use and compare them. Explain post translational modifications. Explain types of RNA	
CO5	Explain enzymes involved in Transcription in prokaryotes as well as eukaryotes. Describe the post transcriptional modifications.	
CO6	Integrate the knowledge of molecular mechanisms with research activities to understand and interpret the alterations happening in the cell structure and functions.	

Unit No.	Title of Unit and Contents	No. of Credits
I	DNA Replication DNA replication in E. coli, Origin of replication, types of E. coli DNA polymerases, details of replication process, prokaryotic regulation of replication, connection of replication to cell cycle. Different models of replication for linear and circular DNA, Eukaryotic DNA replication, multiple replicons, eukaryotic DNA polymerases, details of eukaryotic replication, eukaryotic regulation of replication.	1
II	Transcription Enzymes involved in transcription, Transcriptional Unit in prokaryotes and eukaryotes, role and significance of promoter, enhancer, silencer, Transcriptional factors, mechanism of prokaryotic gene transcription, structure of	1

	RNA polymerase, details of transcription process of both Eukaryote and Prokaryote, Post transcriptional modification.	
III	<p>Translation Genetic code- properties and deciphering genetic code Requirement of translation, mRNA, tRNA and rRNA, structure of ribosomes and its biosynthesis, initiation, elongation and termination factors, aminoacyl tRNA synthetase, activation of amino acids, prokaryotic and eukaryotic translation, translation inhibitors, post translational modification.</p> <p>Gene Regulation- Concept of operon, Lac operon, Trp operon, Arabinose operon.</p>	1
IV	<p>DNA damage and repair system, Techniques in Molecular Biology DNA damage, DNA repair systems: Direct repair, Nucleotide excision repair, Base excision repair, mismatch repair, SOS Repair, Protein-DNA interaction in-vitro and in-vivo techniques, protein-protein interaction techniques.</p> <p>Enzymes in rDNA Technology Introduction, DNA modifying and degrading enzymes used in recombinant DNA technology</p> <p>Vectors in rDNA technology- Cloning vectors – plasmid vectors, cosmids, BACs, YACs</p>	1

References:

1. Molecular Biology of the cell– Bruce Alberts – J.D. Watson et al Garland publishing Inc., N.Y. (1983) and recent edition.
2. Cell and Molecular Biology – De Robertis and Saunders (1980). B.I. Publication.
3. The cell – C.P. Swanson, Prentice Hall (1989)
4. Molecular biology by Lodish and Baltimore
5. Molecular biology of gene by J. D. Watson
6. Miller, J.H. (1972) Experiments in molecular genetics. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY.
7. Genes IX, 9th edition (2008), Benjamin Lewin, Publisher – Jones and Barlett Publishers Inc.
8. Molecular Biology of the Gene, 5th Edition (2004), James D. Watson, Tania Baker
9. Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick.
10. Pearson Education, Inc. and Dorling Kindersley Publishing, Inc. 26
11. Molecular Biology, 4th Edition (2007), Weaver R., Publisher-McGraw Hill Science.
12. Molecular Biology of the Cell, 4th Edition (2004), Bruce Alberts, Dennis Bray, Julian
13. Lewis, Martin Raff, Keith Roberts, and James D. Publisher: Garland Publishing.
14. Essential Cell Biology, 2nd Edition (2003) Bruce Albert, Dennis Bray, Karen Hopkin,

15. Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, Publisher: Garland Publishing.
16. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi, Publisher: Oxford University Press.
17. Primrose S., Twyman R., Old D., Sixth Edition (2001) Principles of Gene Manipulation, Blackwell Science Ltd.
18. Prirose S., Twyman R., Third Edition (2003) Principles of genome analysis and genomics., Blackwell Science Ltd.
19. Alcamo I. Second Edition (2001) DNA Technology, the awesome skill, Harcourt Academic Press
20. Brown T.A., Third Edition (2007) Genomes 3, Garland Science, Taylor and Francis Group.

S.Y. M.Sc. Semester III

Title of the Course and Course Code	Advanced Biostatistics ZOO5303	Number of Credits : 04
<u>Course Outcomes (COs)</u>		
On completion of the course, the students will be able to:		
CO1	Describe statistical data representation and interpretation methods	
CO2	Explain collection and presentation of statistical data by using different methods.	
CO3	Illustrate descriptive statistical methods like Mean, Median and Mode, Measures of dispersion and Probability	
CO4	Classify various statistical methods and interpretation	
CO5	Review Concepts used in Testing of Hypothesis and Probability	
CO6	Application of statistical methods and prepare a report on given statistical data and its analysis	

Unit No.	Title of Unit and Contents	No. of Credits
I	<p>Introductory Biostatistics, Data Representation, and Interpretation</p> <p>Importance of Statistics in Biology. Types of data, Random sampling (SRSWR and SRSWOR), Attributes and Variables, Collection and presentation of data, tabulation. Diagrammatic representation (Simple bar diagram, sub-divided bar diagram and pie chart). Graphical representation (Histogram and frequency polygon, boxplot)</p>	1
II	<p>Descriptive Statistics, Correlation and Linear Regression</p> <p>Measures of central tendency–Mean, Median, Mode. Measures of dispersion–Range, Standard deviation and Variance. Measures of Skewness and Kurtosis Concept of correlation. Methods of studying correlation. Coefficient of correlation. Concept of regression. Difference between correlation and regression. Regression lines and regression equations.</p>	1

III	<p>Probability and Probability Distribution</p> <p>Concept of Probability – classical definition, mutually exclusive events, independent events. Discrete and continuous random variable. Concept of density and mass function. Binomial distribution, Poisson distribution. Computing Binomial and Poisson probabilities. Normal distribution. Properties of Normal distribution. Computing Normal curve probabilities.</p>	1
IV	<p>Testing of Hypothesis and Non-parametric tests</p> <p>The concepts of Null hypothesis, alternative hypothesis, significance level, Type-I and Type-II errors, p-value, one tailed and two tailed tests, degrees of freedom. Equality of two population means - large samples and t-test. Paired t test. χ^2(Chi square) test –test for goodness of fit, independence of attributes (2X2 contingency table) Non parametric tests.</p>	1

References:

1. Goon, Gupta and Dasgupta Fundamentals of Statistics, World Press Kolkata
2. Gupta S. P. Statistical Methods, Sultan Chand & Sons Publisher, New Delhi
3. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics.
4. 3rdEd. Ukaaz, Publications, Hyderabad
5. Bernard Rosner Fundamentals of Biostatistics, 5thEd. Duxbury Thomson
6. Norman T.J. Bailey Statistical methods in biology, 3rdEd. Cambridge University Press

S.Y M.Sc. (Zoology) Semester III		
Title of the Course and Course Code	Zoology Practical-V Evolutionary Biology and Molecular Biology ZOO5304	Number of Credits -4
Course Outcomes (COs) On completion of the course, the students will be able to:		
Evolutionary Biology		
CO1	Describe Geological time scale.	
CO2	Explain different theories of evolutionary biology	
CO3	Illustrate variation in birds.	
CO4	Differentiate different stages in human evolution.	
CO5	Review balanced polymorphism with the help of different examples	
CO6	Write a report on natural selection in nature	
Molecular Biology		
CO1	Study of microbial culture.	
CO2	Describe and demonstrate the experiment for preparation of Plasmid DNA.	
CO3	Demonstrate and isolate the RNA and DNA from bacteria/liver/plant/yeast source/mammalian source.	
CO4	Differentiate and demonstrate PCR technique.	
CO5	Study of Dialysis, reverse Dialysis and membrane filtration, antibiotic susceptibility.	
CO6	Determination of T _m and study of Agarose Gel Electrophoresis of DNA and molecular size determination.	

Zoology Practical-V Evolutionary Biology and Molecular Biology ZOO5304		
Sr.No	Title of The Practical	
1	Study of human evolution with the help of charts /models.	1p
2	Study variation in birds from same genus,	2p
3	Prepare a paper model of Geological time scale	1p
4	Study of different theories of evolutionary biology	1p
5	Study of palaeontological evidences in favour of evolution.	1p
6	Experimental Verification of Balanced Polymorphism through examples.	1p
7	Report submission on study of natural selection in nature with the help of different examples	1p
8	Identify the following pictograms and describe the type of Speciation	1p
9	Study of connecting/ missing links with the help of suitable example	1p
10	Study of streaking/pouring technique for microbial culture by using Laminar air flow.	1p
11	Study of Antibiotic susceptibility in microbial culture.	1p
12	Isolation and estimation of DNA from prokaryotic organism (bacteria)	2p

13	Isolation and estimation of DNA from eukaryotic organism (yeast/ mammals)	2p
1	Separation of DNA by using Agarose gel electrophoresis.	1p
14	Study of subcellular fractionation by centrifugation.	1p
15	Study of principle and working of PCR technique. (D)	1p
16	Dialysis, reverse dialysis and membrane filtration.	2p
17	Visit to Biological research institute.	1p
18	Visit to wildlife sanctuary, coastal area. (Report of Visit)	

S.Y M.Sc. (Zoology) Semester III		
Title of the Course and Course Code	Zoology Practical-VI Biostatistics and Bioinformatics and Skills in Scientific Communication and Writing OR Histology and Histochemistry ZOO5305	Number of Credits -4
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
Advanced Biostatistics		
CO1	Explain methods of Diagrammatic and graphical representation of data	
CO2	Illustrate measures of central tendency and dispersion, skewness and kurtosis	
CO3	Determination of correlation and regression	
CO4	Study of t -test and chi square test	
CO5	Computing probabilities for Binomial, Poisson and Normal distributions using R software	
CO6	Analysis of non parametric test	
Skills in Scientific Communication and Writing		
CO1	Describe method of Proposal writing.	
CO2	Explain methods of Group discussion and personal interview.	
CO3	Illustrate different methods of Review of literature.	
CO4	Differentiate different method of Report writing.	
CO5	Review Citations of research papers	
CO6	Write a scientific report.	
OR		
Histology and Histochemistry		
CO1	Identify and describe histological structures of various organs. Label the parts of figures of organs. Locate the glycogen, proteins in the sections of liver and thyroid glands.	
CO2	Identify and explain histopathological changes in gastric ulcers, cirrhosis of liver, breast tumors, cystic follicles of ovary. Compare the histopathological changes with normal histological structures of stomach, liver and ovary.	
CO3	Demonstrate DNA barcoding technique.	
CO4	Compare the histological structures of different organs and explain their characteristics.	
CO5	Apprise the procedures of preparation of various fixatives and outline the method of preservation of tissues.	
CO6	Assemble the set of microtomy to prepare permanent slides of different tissues and prepare a flowchart for staining the permanent slides.	

S.Y M.Sc. (Zoology) Semester III

Zoology Practical-VI		
Advanced Biostatistics and Skills in Scientific Communication and Writing		
OR Histology and Histo-chemistry		
ZOO5305		
Sr.No	Title of The Practical	
1	Diagrammatic and graphical representation of data in R software.	1p
2	Measures of Central Tendency and Dispersion	1p
3	Measures of Skewness and Kurtosis	1p
4	To find Correlation and Regression from the given data.	1p
5	Computing probabilities for Binomial, Poisson and Normal distributions using R software	1p
6	Study of t – tests using suitable examples	1p
7	To study the application of χ^2 (Chi-square) tests using R software	1p
8	Study of Non parametric tests in analysis of biological data	
OR		
1	Method of Proposal writing	1p
2	Method of Report writing	1p
3	Review of literature	1p
4	Citations of research papers	1p
5	Group discussion on given topic	1p
OR		
1	Microtomy and preparation of permanent Histological slides	3p
2	Observations of histological sections of mammalian organs – stomach, intestine, lungs, kidney, spleen, thymus, bone.	1p
3	Histochemical localization of glycogen in liver from suitable material by Bauer Feulgen technique.	1p
4	Histochemical localization of proteins in rat/mouse thyroid by Mercury bromophenol blue method.	1p
5	Study of DNA Barcoding technique.	1p
6	Study of histopathological changes (permanent slides) – gastric ulcers, cirrhosis of liver, breast tumors, cystic follicles of ovary	1p

- Any Ten practical's will be conducted
- Any other practical suggested by the teacher can be taken.
- Practicals will be conducted with the help of charts/cards/models/ICT tools.

S.Y. M.Sc. Semester III		
Title of the Course and Course Code	Skills in Scientific Communication and Writing ZOO5306	Number of Credits : 04
<u>Course Outcomes (COs)</u> On completion of the course, the students will be able to:		
CO1	Describe concept and salient features of Language as a communication tool, errors, Oral presentation and basics of scientific writing.	
CO2	Explain Survey of literature, defining the problem, justification and reproducibility.	
CO3	Illustrate text and data presentation, tables, graphs, histograms, diagrams, photographic plates, legends and captions. Demonstration of Logical sequence, dealing with discrepancies, unexpected findings and limitations, first draft and revision of draft, importance of discussion	
CO4	Outline concept of Title designing, Key words, Abstract, Summary and Acknowledgements, Cover letters; Letters of recommendation.	
CO5	Explain Citation, Editing, Posters and Conference Abstracts, Elements of a poster and their location.	
CO6	Integrate the knowledge of Research grant proposal writing, Curriculum vitae and different styles of resumes, Self-learning assignment.	

Unit No.	Title of Unit and Contents	No. of Credits
I	<p>Introduction Language as a communication tool, relationship among reading, writing, hearing and speaking, synonyms and antonyms, Jargons</p> <p>Errors Common errors in written and spoken presentation: tautology, double negative, superfluous words, sequence and tenses.</p> <p>Oral Presentation Oral presentation: How to prepare a presentation, power point slides, use of communication and IT, Voice, speed of delivery, obstacles in effective communication</p> <p>Basics of Scientific writing Scientific writing basics: Style and composition- Words, Technical sentences, Paragraphs, Method of writing research paper, Ethics for research</p>	1

II	<p>Introduction Introduction: Survey of literature, defining the problem and justification</p> <p>Materials and Methods Materials and Methods: components, format, references, importance of measurements, reproducibility</p> <p>Observations and Results Observations and Results: text and data presentation, tables, graphs, histograms, diagrams, photographic plates, legends and captions</p> <p>Discussion : Logical sequence, dealing with discrepancies, unexpected findings and limitations, first draft and revision of draft, importance of discussion</p>	1
III	<p>Title, Summary, Acknowledgements Title designing, Key words, Abstract, Summary and Acknowledgements</p> <p>Citation: How to find references from journals, books and data bases, styles of citations</p> <p>Editing and correcting: proof- reading symbols, and abbreviations</p> <p>Posters and Conference Abstracts: Different formats, Elements of a poster and their location, preparation and presentation; Conference abstract</p>	1
IV	<p>Proposal Writing Research grant proposal writing: types of proposals, basic sections of a proposal, different sponsoring agencies, letters of inquiry, online resources</p> <p>Writing for Job Applications Curriculum vitae and different styles of resumes, Application with research statements, teaching statements; Cover letters; Letters of recommendation</p> <p>Experiential Learning: Self-learning assignment</p> <p>Plagiarism :Types of plagiarism, rules of plagiarism and plagiarism checker</p>	1

References

1. Imms' Text book of Entomology- By O. W. Richards and R. G. Davies, (Methuen & Cc., London,), Vols. I & II.
2. Principles of Insect Morphology- By R. E. Snodgrass, (Tata, McGraw- Hill, Bombay.
3. Introduction of Comparative Entomology- By R. M. Fox & J. W. Fox, (Reinhold, New York,).
4. The Insect: Structure & Function- By R.F. Chapman (E. L.B.S., & E.U.P. London,).
5. General & Applied Entomology- By K.K. Nayar, T.N. Anathakrishnan & B.V. David, (Tata, McGraw-Hill, New Dehli,).
6. A Text book of Entomology' by H. H. Ross (John Wiley and Sons, Ins. New York,).
7. A text book of Insect endocrinology and physiology- Tembhare D.B.-S.Chand publication

8. O'Conner, M and Woodford, F.P.(1975). Writing scientific papers in English. Elsevier Excerpta Medica-North Holland pul., Amsterdam.
9. Trelease, S.F. (1958). How to write Scientific and Technical papers. Williams and Wilkins Co. Baltimore, USA 20
10. Robert Day (1996). How to write and publish a Scientific Paper. Cambridge University Press
11. McMillan, V (1997). Writing Papers in the Biological Sciences. Edn. 2, W.H. Freeman. New York
12. G. Vijayalakshmi and C. Sivapragasam. (2008) Research Methods –Tip & Techniques, MJP Publishers, Chennai. WWW.mjppublishers.com
13. Hoffman Angelika H. - Scientific Writing and Communication, 2nd edition 2014, OUP.

S.Y. M.Sc. Semester III

Title of the Course and Course Code	Histology and Histochemistry (ZOO5308)	Number of Credits : 04
<u>Course Outcomes (COs)</u> On completion of the course, the students will be able to:		
CO1	Describe the concept of histology, histochemistry, histopathology and immunohistology Identify and label microscopic structure of various organs. Explain the principle of microscopy and cryo-technique.	
CO2	Compare histological and histopathological structure of different regions of gastro intestinal canal and explain the structure of stomach and intestine, lungs, kidney, spleen, thymus, Bone and bone marrow. Classify Proteins, Relate etiology, pathogenesis and histopathology of Liver cirrhosis, atherosclerosis, neuropathology of alcoholism and methanol poisoning.	
CO3	Illustrate the process of permanent slide preparation, immunofluorescence technique, and mechanism for the Identification of Total Proteins and Glycoproteins	
CO4	Explain types of degeneration clouding, hyaline, hydrophic and fatty degeneration, microtome, method of Immunohistochemistry and immunofluorescence.	
CO5	Appraise applications of different types of microscopes, techniques for localization of proteins in endocrine cells, in endocrine cells, <i>In situ</i> hybridization of nucleic acids, Importance of Enzyme histochemistry.	
CO6	Specify and compile applications of Cryotechniques, Cryoultramicrotomy, microscope, Importance of Enzyme histochemistry, Application of Histochemical methods for the detection of various types of Carcinoma and Immunofloroscent techniques.	

Unit No.	Title of Unit and Contents	No. of Credits
I	Histology and its techniques 1.1. Microscopy: Principle, and applications of different types of microscopes Light, Phase Contrast, Electron: SEMUTEM 1.2. Microtome: Types and applications. Collection & preservation of animal tissue – fixation, embedding, Sectioning, Staining. 1.3. Tissue preparation for light microscopy. 1.4. Cryotechniques: History and applications of Cryotechniques, Cryoultramicrotomy.	1

II	<p>Histology and Histopathology of Mammalian tissues:</p> <p>2.1 Histology: Histological organization of stomach, intestine, lungs, kidney, spleen, thymus, Bone and bone marrow.</p> <p>2.2 Histopathology: Morphological alterations in cells due to disease, types of degeneration cloud, hyaline, hydrophic and fatty degeneration.</p> <p>2.3 Etiology, pathogenesis and histopathology of Liver cirrhosis and atherosclerosis, Neuropathology of alcoholism and methanol poisoning.</p>	1
III	<p>Immunohistochemistry</p> <p>3.1 Principles and applications of Immunohistochemistry and immunofluorescence techniques for localization of proteins in endocrine cells (Pituitary cell types or islet of Langerhans) <i>In situ</i> hybridization of nucleic acids</p> <p>3.2 Histochemical classification of Proteins</p> <p>3.4 Principles and mechanism for the Identification of Total Proteins and Glycoproteins (Bromophenol Blue & Congo red method)</p>	1
IV	<p>Histochemistry</p> <p>4.1 Cryostat and Importance of Enzyme histochemistry.</p> <p>4.2 Localization of enzymes in tissues, Alkaline and Acid phosphates.</p> <p>4.3 Application of Histochemical methods for the detection of various types of Carcinoma</p>	1

REFERENCES:

1. Pearse, A.G.E. (1980): Histochemistry, theoretical and Applied, J & A, Churchill Ltd., London.
2. Rogers, A.W. (1983): Cells and Tissues, An introduction to Histology and Cell Biology, Academic Press, NY.
3. Histology, 1977, 4th Edn. R. O. Greep and L. Weiss, McGraw Hill Int. Book Co. New York.
4. Hand book of Basic Microtechnique, 1964, 3rd Edn. Peter Gray, McGraw Hill Book Co. New York.
5. Bailey's Textbook of Histology - Williams and Wilkins Baltimore and Scientific Book Agency, Culcutta Copenhagen W. M.
6. Essential Histology, 2001, 2nd Edition, David H. Cormack, Lippincott Williams & Wilkins, Philadelphia

S.Y. M.Sc. Semester IV

Title of the Course and Course Code			Number of Credits : 04
ZOO5401	Project work and Dissertation/ Summer Training / Institutional trainings	P-Special-1	08
OR			
ZOO5401	Moocs to be selected by students	M-Special-1	08

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