Rajeev Gandhi Govt. P.G. College Ambikapur

CHOICE BASED CREDIT SYSTEM **(CBCS)**
Master of Science
in
Zoology Syllabus

SEMESTER SYSTEM
SESSION 2023-24

Affiliated PG Colleges of Sant Gahira Guru Vishvavidyalaya
Ambikapur, CG-497001

Rajeev Gandhi Govt. P.G. College Ambikapur
DEPARTMENT OF ZOOLOGY

Program out Come-

PO-1 Knowledge and Understanding- After studying this program, student will be more equipped to learn and know about different biological system. Drawing upon this knowledge.

PO-2 Critical Thinking-They will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of different forms of life.

PO-3 Problem Solving-Student will be able to explain how organisms function at the level of the gene, genome, cell, tissue and organ-system.

PO-4 Analytical reasoning-Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.

PO-5 Academic Knowledge-Apply the Knowledge of internal structure of cell, its functions in control of various metabolic function of organism.

PO-6 Research Skill-Correlates the physiological processes of animals and relationship of organ systems.

PO-7 Business Skill enhancement Course-Gain knowledge of Agro based small scale industries like Sericulture, fish farming, butterfly farming and vermicompost preparation.

PO-8 Human welfare-Understands about various concepts of genetics and its importance in human health.

PO-9 Ethic awareness-Apply ethical principles and commit to professional ethics and responsibilities in delivering his duties. Develops empathy and love towards the animals.

Program Specific Outcomes

1.PSO - Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied Zoology.

2.PSO-Analyse the relationships among animals, plants and microbes.

3.PSO-Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, tools and techniques of Zoology, Animal biotechnology, Immunology and research methodology.

4.PSO-Understand the applications of biological sciences in Apiculture, Aquaculture, Agriculture and Medicine.

5.PSO-Gains Knowledge about research methodologies, effective communication and skills of problem solving methods.

ACADEMIC PROGRAMMES & SCHEMES
M.Sc. Zoology FIRST SEMESTER (CBCS System)

Paper	Course Type	Course (Paper/Subjects)	Credit	Ex Exam	Cont. Int. Valuation				
				M	test	Semi	Assig	Total	Grand Total
I.	CCC(11)	Systematics, Biodiversity and evolution	06	70	10	10	10	30	100
II.	CCC(12)	Principles of Ecology	06	70	10	10	10	30	100
III	CCC(13)	Computational Biology, Biostatics and Bioinformatics	06	70	10	10	10	30	100
IV	OSC(14)	Social Outreach and Skill Development	06	70	10	10	10	30	100
V	ECC(15	Constitutionalism & Indian political system	06	70	10	10	10	30	100
	ECC	Entomology-Insect Diversity, Society and Evolution theory							
	ECC	Entomology-Insect Physiology, Toxicology &Vector Biology							
	ECC	Entomology-Pest Ecology &Agricultural Entomology							
	ECC	Invertebrate-Structure and Function							
Pra-I	Practical/Lab work	Systematic, Biodiversity and Ecology	3	100					100
Pra-II	Prac/Lab	Nonchordata, Computational biology and Biostatistics	3	100					100
		Total	36	700					700

FIRST SEMESTER ZOOLOGY

Course Code	Course Type	Course (Paper/Subjects)	Credits	Hours Per Week			ESE Duration	
				L	T	P	Thy	P
ZOO (11)	CCC	Systematics, Biodiversity and Evolution	6	4	2	0	3	0
ZOO (12)	CCC	Principles of Ecology	6	4	2	0	3	0
ZOO (13)	CCC	Computational Biology, Biostatistics and Bioinformatics	6	4	2	0	3	0
ZOO (14)	OSC	Social outreach and Skill Development	6	4	3	0	3	0
ZOO (15)	ECC	Constitutionalism &Indian Political system	6	4	3	0	3	0
ZOO	ECC	Entomology-Insect Diversity, Society and Evolution theory						
ZOO	ECC	Entomology-Insect physiology, Toxicology &Vector Biology						
ZOO	ECC	Entomology-Pest Ecology & Agricultural Entomology						
ZOO	ECC	Invertebrate-Structure and Function						
Pra-I		Systematics, Biodiversity and Ecology	3					3
Pra-II		Invertebrate (Entomology), Computational Biology and Biostatistics	3					3
	Total	**Credit**	36					

M.Sc. Zoology SEMESTER-1 Paper-I

Course ZOO (11) CCC: Systematics, Biodiversity and Evolution

After successfully completing this course, the students will be able to:

CO-1 An insight to the overview of evolutionary biology, concept of organic evolution .

CO-2 Understanding of the universal common ancestor and tree of life, three domain concept of living kingdom

CO-3 Conceptualization of mode of speciation, evolution, and rules of zoological nomenclature

CO-4 Understanding the current status and future of biodiversity.

CO-5 Description of molecular clocks and molecular drive, origin and diversification of eukaryotes and evolution of man

CO-6 Developed understanding on the diversity of life with regard to non chordates and chordates.

CO-7 Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.

CO-8 Understand how morphological change due to change in environment helps drive evolution over a long period of time.

Mapping of Programme and Course outcome

(Systematics, Biodiversity and Evolution)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO-1	Knowledge, understanding	✓							
PO-2	Critical Thinking		✓					✓	
PO-3	Problem Solving						✓		
PO-4	Analytical Reasoning			✓					✓
PO-5	Academic Knowledge				✓				
PO-6	Research Skill								
PO-7	Business Skill								
PO-8	Human Welfare					✓			
PO-9	Ethics Awareness								

M.Sc. (ZOOLOGY)		IST SEMESTER	
COURSE CODE: ZOO (11)		**COURSE TYPE: CCC**	
COURSE TITLE: Systematics, Biodiversity and Evolution			
THEORY: 5	**PRACTICAL:2**	**THEORY:90**	**PRACTICAL: 45**
THEORY: 100 (30+70)		**PRACTICAL:33**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts related to Systematics, Biodiversity and Evolution.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

18 Hours	Origin of life-1.Pre and post Darwin Period 2. A new synthesis Theory. Biosystematics -3Historical resume of systematic 4 Importance & applications of biosystematics in biology.
18 Hours	Biosystematics-1.Chemotaxonomy, Cytotaxonomy 2.MolecularTaxonomy 3.Taxonomic characters and different kinds 4.Origin and diversification of Bacteria 5.Causes of extinction.
18 Hours	1 Theories of biological classification 2.Hirarchy of categories 3.Origine of reproductive isolation –biological mechanism of genetic incompatibility 4. Mechanisms of speciation (Allopatric, sympatric, parapatric) 5.Species concepts-species category (sub species and infra specific categories)
18 Hours	Taxonomy-1.Types of taxonomic key this merits & demerits 2.Taxonomic procedures-taxonomic collections, presentation curetting process and identification 3.Internatinal code of Zoological nomenclature (ICZN). Its operative principles and application of important rules 4.Zoological nomenclature-Formation of scientific names of various taxa 5.Biodiversity-deffination types & their conservation and management.
15 Hours	1. Molecular clock 2.Molecular drive 3.Origin and diversification of Eukaryotes 4. Formation of Fossils 5. Evolution of Man.
SUGGESTED READINGS	1. *Evolution*, Barton, N. H., Briggs, D. E.G., Eisen, J. A., Goldstein, A. E., Patel, N. H., Cold Spring Harbor Laboratory Press, New York, USA 2. *Evolution*, Hall, B. K. and Hallgrimsson, B., Jones and Bartlett Publisher, Sudbury, USA 3. *Evolution*, Futuyma, D. J., Sinauer Associates, Inc., Sunderland, USA 4. *What Evolution Is*, Mayr, E., (2001), Basic Books, New York, USA

M.Sc. ZOOLOGY (SEMESTER I) PAPER-II

Course ZOO (12) CCC Principles of Ecology

After successfully completing this course, the students will be able to:

CO1• Understanding the environmental concepts, characteristics of population and population dynamics and prey predator interactions

CO 2• Description of nature of ecosystem, production, food webs, energy flow and biogeochemical cycles,

CO 3• Understanding the concept of stress physiology and homeostasis.

CO 4 Know the evolutionary and functional basis of animal ecology.

CO 5 Engage in field based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.

CO 6 Analyse a biological problem, derive testable hypotheses and then design experiments and put the tests into practice

CO 7 Solve the environmental problems involving interaction of humans and natural systems at local or global level.

Mapping of Programme and Course outcome

(Principles of Ecology)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1	Knowledge, understanding	✓		✓			
PO-2	Critical Thinking		✓				
PO-3	Problem Solving						✓
PO-4	Analytical Reasoning						✓
PO-5	Academic Knowledge				✓		
PO-6	Research Skill					✓	
PO-7	Business Skill						
PO-8	Human Welfare					✓	
PO-9	Ethics Awareness						

M.Sc. (ZOOLOGY)		IST SEMESTER	
COURSE CODE: ZOO (12)		**COURSE TYPE: CCC**	
COURSE TITLE: Principles of Ecology			
THEORY: 5	**PRACTICAL:2**	**THEORY:90**	**PRACTICAL:45**
THEORY: 100(30+70)		**PRACTICAL:33**	

OBJECTIVE: The purpose of the course is to make the students to understand various ecological principles and factors that determine the size and number of population that can co-exist within a specific area. This knowledge is crucial for better development and management of natural resources and global environment.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

18 Hours	Ecology-1.Abiotic factor and biotic factor 2.Population growth (Mathematical and logistic Model) 3.Population density 4.Food Webs 5.Energy flow Through Ecosystem 6.Prey predator interactions
18 Hours	Environmental Stress-1.Biochemical cycle 2.Environmental Hazards and its management 3.Global warming 4.Atmospheric Ozone 5.Acid rain 6.Nitrogen deposition.
18 Hours	Pollution and pollutant-1.Water pollution 2.Air pollution 3.Noise pollution 4. Radioactive pollution 5.Pesticides and other chemicals in agriculture.
18 Hours	1. Community ecology 2.ecological succession 3.Level of adaptation 4. Mechanism of adaptation 5.Marine and terrestrial adaptation.
18 Hours	Stress physiology-1.Basic concept of environmental stress and homeostasis 2.Mechanism of thermoregulation 3. Osmoregulation of Aqueous and terrestrial Environment 4.Physiological response to Oxygen deficient stress 5. Physiological response to body Exercise 6.Yoga and their effects.
Suggested reading	1. *Field Sampling: Principles and Practices in Environmental Analysis*, Conklin, A.R. Jr., (2004), CRC Press. 2. *Principles and Standards for Measuring Primary Production*, Fahey, T.J. and Knapp, A.K., (2007), Oxford University Press, UK 3. *Ecological Modeling*, Grant, W.E. and Swannack, T.M., (2008), Blackwell. 4. *Fundamental Processes in Ecology: An Earth system Approach*, Wilkinson, D.M., (2007), Oxford University Press, UK.

M.Sc. I SEMESTER

Course ZOO (13) CCC: Computational Biology, Biostatistics and Bioinformatics.

After successfully completing this course, the students will be able to:

CO-1 Introduction to basic components of computers, Software (operating systems) and application software used in biological and statistical studies.

CO-2 To get an insight into the advancement in computerized biology information, introduction to genomics and proteomics databases.

CO-3 Perform and interpret bioinformatics and statistical analyses with real molecular biology data.

CO -4 Learning to programming languages such as "C

CO -5 Acquire knowledge of various databases of proteins, nucleic acids. Primary, secondary and composite databases. BLAST.

Mapping of Programme and Course outcome

(Computational Biology, Biostatistics and Bioinformatics)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO-1	Knowledge, understanding	✓							
PO-2	Critical Thinking		✓					✓	
PO-3	Problem Solving						✓		
PO-4	Analytical Reasoning			✓					✓
PO-5	Academic Knowledge				✓				
PO-6	Research Skill								
PO-7	Business Skill								
PO-8	Human Welfare					✓			
PO-9	Ethics Awareness								

M.Sc. (ZOOLOGY)		IST SEMESTER	
COURSE CODE: ZOO(13)		**COURSE TYPE: CCC**	
COURSE TITLE: Computational Biology, Biostatistics and Bioinformatics			
CREDIT:7		**HOURS:135**	
THEORY: 5		**THEORY: 90**	**PRACTICAL: 45**
THEORY: 100 (30+70)		**PRACTICAL: 34**	

OBJECTIVE: The Purpose of this course is to make the students to understand computational biology- Bioinformatics & Biostatistics.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

20 Hours	Basic Knowledge of computer-1.Hardware- (CPU, input, output, storage devices) 2.Software (Operating system) 3.Application software-Introduction to MSEXCEL (use of worksheet to enter data, edit data ,copy data move data) 4. Use of in-built statistical functions for computations of mean, S.D. , Correlation, regression)5. Introduction to MS WORD 6.Introduction to Power Point.
15 Hours	Presentation of data-1.Bar diagram 2.Histograms 3. Pie diagram 4. Mean 5. Median 6.Mode 7.Standerd deviation8. P value of the statistic.
15 Hours	1. correlation coefficient (r), properties (without proof) 2 regression 3.chi-square test 4. P- value of the statistic 5.Introduction to one way and two- way analysis of variance 6.Probability distribution and their properties 7.Probability theory 8. Hypothesis testing.
-20 Hours	1. Analysis of Frequencies 2.Mahtematical Modeling 3.Matrices and vectors 4. Exponential functions 5.Introduction to bioinformatics 6.Nucleotide sequence data base 7. Use of bioinformatics 8.Gene bank.
20- Hours	1.BLAST-(steps involved in use and interpretation of result 2.Identification characterization of protein mass finger print 3.Introduction to computer language 4.Word wide biological data base 5. Protein structure analysis
SUGGESTED READINGS	1. *Principles of Biostatistics*, Pagano M., Gauvreau, K, (2000), Duxbury Press, USA 2. *Bioinformatics for Dummies*, Claverie J. M., Notredame C., (2nd Ed., 2007), Wiley Publishing, Inc., New York, USA 3. *Bioinformatics: Sequence and Genome Analysis*, Mount, D. W. (2nd Ed., 2001), Cold Spring Harbor Laboratory Press, New York, USA. 4. Animal Ecology, Ranga M.M., Agrobios, Jodhpur, India

M.Sc. I SEMESTER

Course ZOO (14) OSC: Social outreach and Skill Development

CO 1 This course will help students to enhanced the academic skills

CO 2 Developed leadership qualities

CO 3 Developed self confidence

CO 4 Communication skills

CO 5 Managerial skills

CO 6 Responsibilities towards the rural community.

CO 7 Engage in social service

Mapping of Programme and Course outcome

(SOCIAL OUTREACH AND INTERNSHIP)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1	Knowledge, understanding			✓			
PO-2	Critical Thinking					✓	
PO-3	Problem Solving		✓	✓		✓	
PO-4	Analytical Reasoning						
PO-5	Academic Knowledge	✓		✓			
PO-6	Research Skill				✓	✓	
PO-7	Business Skill		✓			✓	
PO-8	Human Welfare			✓	✓	✓	✓
PO-9	Ethics Awareness					✓	

M.Sc.(ZOOLOGY)	I SEMESTER
COURSE CODE: ZOO (14)	**COURSE TYPE: PRJ/FST/EST**
COURSE TITLE: **SOCIAL OUTREACH AND INTERNSHIP** LABORATORY WORK	
OBJECTIVE: The aim of the project work or field work is to introduce students with the research methodology in the subject and to prepare them for the pursuing research in theoretical, experimental or computational areas of the subject.	
Social outreach-report submission:-40 Marks, presentation:-10 Marks **Internship-Theory:-30Marks,Practical:-20 Marks**	

Course ZOO (15) ECC:

Constitutionalism and Indian political system

After successfully completing this course, the students will be able to:

CO 1 Understand the making of Indian constitution along with the debates of constituent assembly.

CO 2 Comprehend the amendment procedure of the constitution and the debate about the basic structure of the constitution.

CO 3 Develop an understanding of various Constitutional statutory bodies.

CO 4 Understand the working of election commission, and electoral process.

CO 5 Understand the division of power between various organs of the government at different levels.

CO 6 This course enables students to develop an understanding of the tenets of Indian constitutionalism by engaging with Constituent Assembly debates.

CO 7 It enables them to understand the working of different organs of government and analyse the interaction amongst them which often involves both conflict and cooperation.

CO 8 Moreover, it enables the students to understand the division of powers in Indian federal set-up and its asymmetrical federal arrangements, with special emphasis on the special provisions for governance in fifth and sixth schedules of the constitution.

CO 9 The students are also familiarized with the process of rural and urban governance and the dynamics of gender and caste in these domains.

CO 10 students would also become familiar with challenges of addressing emergency conditions and security concerns within the constitutional framework.

Mapping of Programme and Course outcome

(CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8	CO-9	CO-10
PO-1	Knowledge, understanding	✓	✓								
PO-2	Critical Thinking		✓					✓			
PO-3	Problem Solving			✓							
PO-4	Analytical Reasoning			✓					✓	✓	✓
PO-5	Academic Knowledge				✓						
PO-6	Research Skill										
PO-7	Business Skill										
PO-8	Human Welfare		✓	✓		✓					
PO-9	Ethics Awareness										

MASTER OF SCIENCE(FIRST SEMESTER)	
COURSE CODE: (15) COURSE TYPE: ECC	
COURSE TITLE:CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM	
CREDIT: 06 **THEORY: 06**	**HOURS : 90** **THEORY: 90**
MARKS : 100 **THEORY: 70 CCA : 30**	
OBJECTIVE: Understands the concept of Constitutionalism. Gets acquainted with various Indian Political System. Becomes familiar with various Union Executive. Gets conversant with Legislatures, Legislative Bills. Achieves skills in various writings	
12 Hrs	1-Meaning: Constitution, Constitutional government & constitutionalism; Difference between Constitution & Constitutionalism; Constitutionalism: Basis, Elements, Features & future. Forms of Government: Democracy & Dictatorship, Unitary & Federal, Parliamentary & Presidential form. Ideals of the Indian Constitution incorporated in the Preamble. Special Features of the Indian Constitution.
24 Hrs	2-Concept of State and Citizenship, Judicial Review and Fundamental Rights, Directive Principles of the State Policy, Fundamental Duties, Procedure to Amend the Indian Constitution, Judiciary: Supreme Court and High Court, Judicial Activism and Public Interest Litigation and Provisions relating to Emergency.
10 **H**	3-Union Executive- President, Prime Minister, Council of Ministers. State Executive- Governor, Chief Minister and Council of Ministers. Local Bodies & Panchayati Raj
24 **Hrs**	4-Parliament of India, State Legislatures, Legislative Bills: Ordinary, Money and Financial, Union State Relations, Principles of the 'Separation of Power and the 'Principles of Check & Balance'. Political Parties and Pressure Groups. Challenges before Indian Democracy: Terrorism, Regionalism, Communalism, *Linguistics* and National Integration.
20 Hrs	5-Controller & Accountant General of India, Solicitor General, Advocate General, Election Commission, Union and State(s) Public Service Commission, Finance Commission.
	HOBBES, Thomas, The Leviathan, Chapters XIII & XVII [entry] LOCKE, John, The Second Treatise of Civil Government, Chapter IX [entry] ROUSSEAU, Jean-Jacques, The Social Contract or Principles of Political Right MONTESQUIEU, The spirit of the laws, RAZ, Joseph, "The rule of law and its virtue", in The authority of law, Oxford University Press, 1979 Dicey on British constitution P. Ishwara Bhat Inter-relationship between Fundamental Rights M P Jain Indian Constitutional Law H M Seervai Constitutional Law of India V N Shukla Constitution of India D DBasu Shorter Constitution of India

M.Sc. I SEMESTER

Course ECC –Entomology - Insect Diversity, Society and Evolution

After successfully completing this course, the students will be able to:

CO •1 Identifying beneficial and harmful insects based on comparative study of morphology and their articulation.

CO •2 Assisting with criminal investigation by evaluating forensically important insects, collection of Data from cadaver site, interpretation of data for predicting time and cause of death.

CO •3 Identifying potential disease vectors.

CO •4 Identifying potential biocontrol agents.

Mapping of Programme and Course outcome

(Entomology - Insect Diversity, Society and Evolution)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓		
PO-3	Problem Solving		✓	✓	
PO-4	Analytical Reasoning			✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill				✓
PO-7	Business Skill				
PO-8	Human Welfare				✓
PO-9	Ethics Awareness				✓

M.Sc. (ZOOLOGY)		**IST SEMESTER**	
COURSE CODE:		**COURSE TYPE: ECC**	
COURSE TITLE: **Entomology- Insect Diversity, Society and Evolution**			
THEORY: 6		**THEORY: 90**	**PRACTICAL: 0**
THEORY: 100(30+70)		**PRACTICAL:0**	
OBJECTIVE: This course is aimed towards generating fundamental knowledge of insects diversity society and evolution theory. Scheme of marks: (i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words) (ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words) (iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)			
18-Hours	Morphology: external features and their articulation. Comparative study of head-antennae, mouth parts; thorax – legs, wings; abdominal appendages, genitalia		
18 Hours	Taxonomy- historical development of classification of insect, basis of insect classification; classification of insects up to sub orders and up to super families in economical important groups; fossil history, origin and evolution of insects		
18 Hours	Insect Society: group of social insects and their social life; evolution of sociality; social organization and social behaviour in honey bee, ants, termites and wasps		
18-Hours	Insect Plant Interaction - Theory of co-evolution, role of allelochemicals in host plant mediation, tritrophic interaction, host-plant selection by phytophagous insects, establishment of insect population on a plant surface.		
18 Hours	Forensic Entomology: Introduction, forensically important insects, collection of data from cadaver site, interpretation of data for predicting time and cause of death.		
SUGGESTED READINGS	1.*A general text book of entomology*, Imms , A. D., Chapman & Hall, UK 2. *Introduction to the study of insects,* Borror, D. J., Triplehorn, C. A., and Johnson, N. F.,M Saunders College Publication, USA 3. *Principles of Insect Morphology*, Snodgrass, R. E., Cornell Univ. Press, USA 4. *The Insect Societies*, Wilson, E. O., Harward Univ. Press, UK 5. *Host Selection by Phytophagous insects*, Bernays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA 6. *Insect Plant Biology*, Schoonhoven, L. M., van Loop, J. A., & Dicke. M. Pub. Oxford Univ. Press. USA		

M.Sc.-I SEMESTER

Course ECC: Insect Physiology, Toxicology& Vector Biology

After successfully completing this course, the students will be able to:

CO 1 Learning methods to effectively restrict insect growth.

CO 2 Devise chemical methods to effectively eliminate harmful insects by mode of action of insecticide.

CO 3 Usage of methods to effectively restrict multiplication of disease causing agents within the insect vector by elucidating mode of action of insecticide, carcinogenic, mutagenic and teratogenic effects, and evaluation of toxicity.

CO4 Learning the methods to control the spread of vectors, their economic importance and control of fleas, lice, bugs, mosquitoes, flies and parasitoids.

Mapping of Programme and Course outcome

(Insect Physiology, Toxicology& Vector Biology)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓		
PO-3	Problem Solving				✓
PO-4	Analytical Reasoning	✓		✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill		✓	✓	
PO-7	Business Skill			✓	✓
PO-8	Human Welfare		✓		✓
PO-9	Ethics Awareness				

M.Sc. (ZOOLOGY)		**IST SEMESTER**	
COURSE CODE:		**COURSE TYPE: ECC**	
COURSE TITLE: **EMTOMOLOGY- Insect Physiology, Toxicology & Vector Biology**			
THEORY: 6		**THEORY:90**	**PRACTICAL: 0**
THEORY: 100 (30+70)		**PRACTICAL-0**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge concepts related to insect physiology toxicology and vector biology.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

20-Hours	1 study of Mouth parts structure and mechanism of feeding .2 External feature of legs structure and physiology of Integumentary. 2 digestive system.3 excretory system.4 circulatory system. 5 Respiratory .6 endocrine gland.
20-Hours	1 Male and female Reproductive system .2 Nervous system-general plan .3 Sensory recepture.4 Diapause in insect 5 Growth and metamorphosis in insects .6 Insecticide and health hazards.
3 ***15- Hours***	1 Defination of pesticides. 2 Group characteristics of insecticide, 4 mode of action of insecticide 3 structure and function of organochlorine.4 organophosphorus . 5 Carbamate .6 pyrethrod. 7 plant origin bio-insecticides- neonicotinoids and nitrogenous insecticide.8Fumigants.
15 Hour	Introduction to vector biology, economic importance and control -1 fleas- 2 lice,3Bugs, 4 Mosquitoes,5 flies and parasitoids.
20 Hour	1Vector-parasite interaction; 2 host-pathogen interaction, 3 control of insect vector. 4 Pest and pest control.
SUGGESTED READINGS	1. *The Insects: Structure and functio*n, Chapman, R. F., Cambridge University Press, UK 2. *Physiological system in Insects*, Klowden, M. J., Academic Press, USA 3. *The Insects, An outline of Entomology*, Gullan, P. J. , and Cranston, P. S., Wiley Blackwell, UK 4. *Insect Physiology and Biochemistry*, Nation, J. L., CRC Press, USA 5. *Toxicology and Risk Assesssment: A Comprehensive Introduction*, Greim H., and Snyder, R. (ed), John Wiley and Sons, UK 6. *The Complete Book of pesticide management,* Whitford, F., Wiley Interscience, John Wiley and Sons, UK 7. *Safer Insecticides*, Hodgson, E., and Kuhr, R. J., (ed), Marcel Dekker Inc., New York, USA 8. *Pesticide Application Methods*, Matthews, G, A., Blackwell Science, London, UK 9. *Pesticide Biochemistry and Physiology*, Wilkinson, C. F., Plenum Press, New York, UK 10. *Metabolic pathways of agrochemicals Part II*, Roberts, T. R., and Hutson, D. H. The Royal Society of Chemistry, UK

M.Sc. I SEMESTER Paper-V

Course ECC: Pest Ecology & Agricultural Entomology

After successfully completing this course, the students will be able to:

CO 1 Identifying pests of agricultural crops by analyzing ecology, pest status, features responsible for evolutionary success of insect species, factors responsible for achieving the status of pest..

CO 2 An overview of identification, seasonal history, biology, nature of damage and control measures of pests, of cereals, pulse crops, cotton, vegetables, oil seeds, fruit crops, sugarcane and stored grains.

CO 3 To devise cropping pattern to minimize crop loss by a detailed understanding of agro-ecosystem, phases of population fluctuation, models of population growth, population size and regulatory mechanisms.

CO 4 A detailed understanding of plant resistance to insects, transgenic plants, development of Bt plant by recombinant DNA technology, resistance management of Bt crop.

Mapping of Programme and Course outcome

(Pest Ecology & Agricultural Entomology)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓		✓
PO-3	Problem Solving		✓		
PO-4	Analytical Reasoning			✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill				
PO-7	Business Skill				
PO-8	Human Welfare	✓	✓	✓	
PO-9	Ethics Awareness				✓

M.Sc. (ZOOLOGY)			IST SEMESTER
COURSE CODE:		**COURSE TYPE: ECC**	
COURSE TITLE: ENTOMOLOGY- **Pest Ecology & Agricultural Entomology**			
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL: 0**
THEORY: 100 (30+70)		**PRACTICAL:0**	

25-Hours	Pest - definition and its ecology, pest status, features responsible for evolutionary success of insect species, factors responsible for achieving the status of pest, Economic injury level, economic threshold, action threshold, pest spectrum, pest complex, carrying capacity, secondary pest out break, pest surveillance and sampling.
15-Hours	Population dynamics of pests - agro-ecosystem, phases of population fluctuation, models of population growth, factors for population fluctuation, population size and regulatory mechanisms.
20-Hours	Identification, seasonal history, biology, nature of damage and control measures of pests, of cereals, pulse crops, cotton, vegetables (summer vegetable and winter vegetable), oil seeds, fruit crops, sugarcane and stored grains. Locust- different species and phases, phase transition, periodicity, migration, biology and control measures
15 Hours	Integrated Pest Management: history, different phases of pest control, Quarantine, Physical, Cultural, Chemical, Biological control and, genetic and biotechnological methods of control. Pheromones- production, and their use in pest surveillance and management
15 Hours	Plant resistance to insects: types of resistance, mechanism of resistance-antibiosis, antixenosis, tolerance, factors mediating resistance, JH Mimics & MH-agonist. Transgenic plants: history, *Bacillus thuriengensis* and its mode of action on insect, different sub species of *Bt* , development of *Bt* plant by recombinant DNA technology, resistance management of *Bt* crop, prospective and controversies of *Bt* crop.
SUGGESTED READINGS	1.*Ecology of insects*, Speight, M. R., Hunter, M. D., & Watt, A. D., Wiley-Blackwell, UK 2. *Insect Plant Biology*, Schoonhoven, L. M., van Loon, J.A., & Dicke, M., Publisher Oxford University Press, USA 3. *Interrelationship between insects and Plants*, Jolivet, P., CRC Press, USA 4. *Chemical Ecology of Insects*, Carde, R. T., and Bell, W. J., Chapman & Hall, New York, USA 5. *Entomology & Pest Management*, Pedigo, L. P.,Prentice Hall, New Jersey, USA 6. *Concepts of IPM*, Norris, Caswell-Chen and Kogan, Prentice-Hall, USA 7. *Agricultural insects pests of the tropics and their control*, Hill, D. S., Cambridge University Press, UK

M.Sc.-I SEMESTER Paper-V

Course ECC; Invertebrates- structure and function

By the end of the course, students should be able to-

CO -1 Describe basis of classification of Invertebrate.

CO -2 Describe different physiological body processes of invertebrates.

CO -3 Describe larval forms of invertebrate.

CO -4 Describe characteristics and significance of Minor Phyla.

CO-5 Understand the relative position of individual organ and associated structures through dissection of the invertebrate representatives.

CO-6 Realize that very similar physiological mechanisms are used in very diverse organisms.

CO-7 Undertake research in any aspect of animal physiology in future.

Relationship of Programme and Course outcome

(Invertebrates- structure and function)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO-1	Knowledge, understanding	✓			✓	✓		
PO-2	Critical Thinking		✓	✓		✓	✓	✓
PO-3	Problem Solving					✓	✓	✓
PO-4	Analytical Reasoning	✓		✓				
PO-5	Academic Knowledge		✓	✓	✓			
PO-6	Research Skill		✓				✓	✓
PO-7	Business Skill							
PO-8	Human Welfare					✓		
PO-9	Ethics Awareness							

M.Sc. (ZOOLOGY)		IST SEMESTER	
COURSE CODE:		**COURSE TYPE: ECC**	
COURSE TITLE: Invertebrates- structure and function			
CREDIT:6		**HOURS:90**	
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL: 0**
THEORY: 100 (30+70)		**PRACTICAL:0**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge concepts related to pest ecology and agricultural entomology.
Scheme of marks:
(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)
(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)
(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

25-Hours	Minor-phyla-Organization and general characters of phoronida, Brachiopoda and Acanthocephala. Locomotion-Flgella and cilliary movement in Protozoa. Hydrostatic movement in coelenterates, Annelida and Echinodermata .
15-Hours	Nutrition and Digestion-Patter's of feeding and digestion in lower Metazoa. Filter feeding in Polychaeta ,Mollusca ,Echinodermata .Respiration –Organs of respiration ,gills ,Lungs and Trachea .
20-Hour	Excretion-Organs of excretion, coelom, coelomoduct, Nephridia and Malpighian tubules .Mechanism of excretion.
15 Hours	Nervous system –Primitive nervous system-Coelentrata and Echinodermata .Advanced nervous system-annelida, Arthropoda (Crustatacea and Insecta), Mollusca .
15 Hour	Invertebrate Larva –Larval forms of free living Invertebrate larva(crustacean and Echinodermata). Larval forms of invertebrate parasites.

Reference

Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition. •
Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science •
Sinha, Chatterjee and Chattopadhyay – Advanced Practical Zoology, Books and Allied •
Lal, S.S. – A textbook of Practical Zoology, Invertebrate, Rastogi Publications •
Verma, P.S. – A manual of Practical Zoology, Invertebrate, S. Chand

M.Sc. first semester

Practical/Lab-Work –I

Systematic, Biodiversity and Ecology

–Model of Human evolution, Slide of prokaryotic and Eukaryotic. Explain the phylogenetic trees .Model of DNA.

–Problem based on Hardy Weinberg low.

-Ecology, ecosystem, Pyramid, Food chain related question.

-Physical and chemical characteristics of Soil.

- Insect diversity in Soil.

-Detection of Gram-negative and Gram positive Bacteria.

-Study of National parks and endangered species.

- Permanent slide preparation of preserve material.

-Identification zooplankton of local pond.

Practical –II

Nonchordata, Computational biology and Biostatistics

Specimen Entomology, Slide Entomology, Pest collection and its identification

Mouth parts-cockroach, Mosquito, culex, etc. dissection-earthworm, pila, unio, palaemon ,cockroach

Practical related to computational biology.

Statistics- correlation, regression, probabilities.

Bar diagram, histograms, Standard deviation .

Estimation of population, density, percentage frequency.

ACADEMIC PROGRAMMES & SCHEMES

M.Sc. (Zoology) II-Semester ZOOLOGY

Paper	Course Type	Course (Paper/Subjects)	Credit	Exte Exam		Cont. Int. Valuation			
				M	W.	Seminar	Assign	Total	Grand Total
II.	CCC(21)	Genetics and Cytogenetics	06	70	10	10	10	30	100
II.	CCC (22)	Principle of gene Manipulation, structure, function of genes	06	70	10	10	10	30	100
III	CCC (23)	Tools and Techniques for biology	06	70	10	10	10	30	100
IV	PRJ/FST/ EST (24)	Research Methodology & Computer Application: Basics	06		10	40	20	30	100
V	ECC	Environmental And Forest Laws		70	10	10	10	30	100
	ECC (25)	Fish Biology-Evolution and Function Anatomy of Fish							
	ECC	Fish Biology-Aquatic Resources and Their Conservation							
	ECC	Fish Biology-Aquaculture							
	Pra-I	Genetics	3	100					100
	Pra-II	Fish and Tools and Technique	3	100					100
		Total: -	36						700

M. Sc. ZOOLOGY SECOND SEMESTER

Course Code	Course Type	Course (Paper/Subjects)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)	
				L	T	P	Thy	P
ZOO (21)	CCC	Genetics and Cytogenetics	6	4	2	00	3	00
ZOO (22)	CCC	Principles of Gene Manipulation, Structure and Function of genes	6	4	2	00	3	00
ZOO(23)	CCC	Tools and Techniques for Biology	6	4	2	00	3	00
ZOO (24)	OSC	Social Outreach and Skill Development	6	1	1	9	00	4
ZOO	ECC	Environmental and Forest Lows	6	4	3	00	3	00
ZOO (25)	ECC	Evolution and Functional Anatomy of Fish						
ZOO	ECC	Aquatic Resources and Their Conservation						
ZOO	ECC	Aquaculture						
Pra	Pra-I	Genetics	3			3		3
	Pra-II	Fish and Tools and Technique	3			3		3
MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IT WOULD BE 30			TOTAL = 36					

a

M.Sc. II Semester Paper-I

Course ZOOL (21) CCC– Genetics and Cytogenetics

After successfully completing this course, the students will be able to:

CO -1 Understanding of Mendel's principle, its extension and chromosomal basis.

CO -2 Determination of gene action from genotype to phenotype including penetrance and expressivity, gene interaction, epistasis, pleiotropy; nature of the gene and its functions.

CO- 3 Evolution of the concept of the gene and fine structure of gene.

CO- 4 Capability to perform gene mapping using 3- point test cross in Drosophila, gene mapping in humans by linkage analysis in pedigrees.

CO- 5 Describing structural and functional organization of a typical eukaryotic gene, transcription factors, enhancers and silencers, and non-coding genes.

CO -6 Depicting the mechanism of sex determination and dosage compensation in human and other model organisms.

CO-7 Understanding the chromosome anomalies and associated diseases.

CO-8 Identify link between genetics and cancer with emphasis on oncogenes, chromosome rearrangement and cancer, tumor suppressor genes and genetic pathways to cancer.

Mapping of Programme and Course outcome

(Genetics and Cytogenetics)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO-1	Knowledge, understanding	✓	✓						
PO-2	Critical Thinking		✓	✓				✓	
PO-3	Problem Solving					✓		✓	✓
PO-4	Analytical Reasoning			✓				✓	✓
PO-5	Academic Knowledge			✓	✓				✓
PO-6	Research Skill					✓			
PO-7	Business Skill							✓	
PO-8	Human Welfare						✓		✓
PO-9	Ethics Awareness								✓

M.Sc. (ZOOLOGY)		**IIND SEMESTER**	
COURSE CODE: (21)		**COURSE TYPE: CCC**	
COURSE TITLE: Genetics and Cytogenetics			
THEORY: 5		**THEORY: 90**	**PRACTICAL:45**
THEORY: 100 (30+70)		**PRACTICAL:33**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts related to genetics and cytogenetics.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- 15*Hours*	1 Mendel's laws and their chromosomal basis. 2 Mendel's low of inheritance. 3Varieties of gene expression- multiple Allele . Lithogene, Pleotropic genes, Epistasis. Interaction of gene.
UNIT-2- *25 Hours*	1Nature of the gene and its functions .2 Fine structure of gene .3 Linkage and crossing over. 4 Linkage Maps, 5 X-linked gene in human.6 Structure of chromosome,7 Special types of chromosomes 8 Cell cycle -Mitosis and meiosis. .
UNIT-3- *15 Hours*	Gene mutation .1 DNA repair –DNA replication and repairing 2 Types of gene 3 Mutations , Method of induced mutation , Enhancers and silencers, Non coding genes , 4 Human genome and mapping.
UNIT-4 *-15 Hours*	1Sex determination and dosage compensation.2 Sex determination- in humans, 3 Sex determination in drosophila .4 Genetic diseases. 5 sex linked in heritance (haemophilia, colour blindness) 6. Sex differentiation .7 Blood group inheritance. 8 Cytoplasmic inheritance.
UNIT-5 2*0 hs*	Genetics and cancer: 1 tumor inducing retroviruses and viral Oncogenes, 2 Chromosome rearrangement and cancer, 3 Chromosomal anomalies in malignancy (chronic myeloid leukemia, Burkitt's lymphoma, retinoblastoma)
	1. *Principles of Genetics*, Snustad and Simmons, (4th Ed. 2005), John Wiley & Sons, USA 2. *Modern Genetic Analysis: Integrating Genes and Genomes*, Griffiths, J.F., Gelbart, M., Lewontin, C. and Miller, W. H. Freeman and Company , New York, USA 3. *Genetics*, J. Russell, Benjamin-Cummings Publishing Company, San Francisco, California, USA

M.Sc. II SEMESTER PAPER-II ZOO(22) CCC –

Principles of Gene Manipulation structure, function of genes

After successfully completing this course, the students will be able to:

CO -1 Imparting knowledge of basic recombinant DNA techniques, preparation of restriction maps and mapping techniques.

CO -2 Understanding of method and applications of nucleic acid probes, blotting techniques, DNA fingerprinting, DNA footprinting, methyl interference assay and polymerase chain reaction.

CO -3 Developing skill to understand biology of cloning and expression vectors.

CO -4 Description of gene cloning strategies by transformation of E. coli and other cells with rDNA; methods of selection and screening of transformed cells; construction of genomic and cDNA libraries.

CO -5 Defining key strategies to express cloned genes including phage display.

CO -6 Exposure to principles of DNA sequencing, automated sequencing methods; synthesis of oligonucleotides, primer design. Understanding a concept of changing genes-directed evolution, protein engineering in microbes.

CO -7 Introduction to gene manipulation methods in animals, transgenic technology, application of recombinant DNA technology; gene knockouts, gene silencing, mouse disease models, somatic and germ- line therapy.

Mapping of Programme and Course outcome

(Principles of Gene Manipulation, structure and function of genes)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO-1	Knowledge, understanding	✓				✓		
PO-2	Critical Thinking	✓	✓					✓
PO-3	Problem Solving						✓	
PO-4	Analytical Reasoning	✓		✓			✓	
PO-5	Academic Knowledge		✓		✓			
PO-6	Research Skill			✓	✓			✓
PO-7	Business Skill							✓
PO-8	Human Welfare				✓	✓		✓
PO-9	Ethics Awareness						✓	✓

M.Sc. (ZOOLOGY)		IIND SEMESTER	
COURSE CODE: (22)		**COURSE TYPE: CCC**	
COURSE TITLE: Principles of Gene Manipulation, structure and function of genes			
THEORY: 5		**THEORY: 90**	**PRACTICAL: 45**
THEORY: 100 (30+70)		**PRACTICAL: 33**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts related to principle of gene manipulation.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1 -18 *Hours*	1 Basic recombinant DNA techniques.2 Cutting and joining DNA molecules, Restriction modification systems. 3 Enzymes used in recombinant DNA technology.4 Structure of nucleic acid-DNA and RNA.
UNIT-2 -18 *Hours*	1 Nucleic acid probe. 2 DNA fingerprinting. 3 Polymerase chain reaction– methods and applications. 4 DNA replication. Gene expression-regulation of protein synthesis -5 Transcription in prokaryotes and eukaryotes. 6 Elongation and termination of transcription.
UNIT-3 -18 *Hours*	Basic biology of cloning-1Types of vectors .2 Plasmids 3 Phages. 3 Gene cloning strategies .4 Methods of transforming *E. coli* .5 Methods of selection and screening of transformed cells .6 DNA libraries.
UNIT-4 -18 *Hours*	1Principles of DNA sequencing .2 Automated sequencing methods 3 Changing genes- directed evolution .4 Gene identification 5 Synthesis and Amplification.
UNIT-5 -18 *Hours*	1 Gene transfer to animal cells 2 Genetic manipulation of animals .3 transgenic technology .4 application of recombinant DNA technology .5 Genetic Code. 6 gene therapy 7 somatic and germ-line therapy.
SUGGESTED READINGS	1. Recombinant DNA: Genes and Genomics – a short course, Watson et al., W. H. Freeman and Company, New York, USA 2. Principles of Gene Manipulation and Genomics, Primrose, S. B. and Twyman, R. M., (7th Ed. 2006), Blackwell Publishing, West Sussex, UK 3. Molecular Biotechnology: Principles and application of recombinant DNA, Bernard R. and Jack, ASM Press, Herndon, USA

M.Sc. II Semester Paper-III

Course ZOO (23): Tools and Techniques for Biology

After successfully completing this course, the students will be able to:-

CO - 1 Understand the purpose of the technique, its proper use and possible modifications/ improvement.

CO -2 Learn the theoretical basis of technique, its principle of working and its correct application.

CO -3 Learn the construction repair and adjustment of any equipment required for a technique.

CO -4 Learn the accuracy of technique.

CO -5 Learn the maintenance laboratory equipments/ tools, safety hazards and precautions.

CO -6 Understand the technique of cell and tissue culture. Learn the preparation of solution of given percentage and molarity.

CO -7 Understand the process of preparation of buffer. Learn the techniques of separation of amino acids, proteins and nucleic acids.

Mapping of Programme Outcome and Course outcome

(Tools and Techniques for biology)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO-1	Knowledge, understanding	✓						✓
PO-2	Critical Thinking	✓	✓					✓
PO-3	Problem Solving				✓	✓		
PO-4	Analytical Reasoning		✓	✓	✓	✓		
PO-5	Academic Knowledge				✓			✓
PO-6	Research Skill		✓			✓	✓	
PO-7	Business Skill							
PO-8	Human Welfare					✓	✓	
PO-9	Ethics Awareness							

M.Sc. (ZOOLOGY)			IIND SEMESTER
COURSE CODE: (23)			**COURSE TYPE: CCC**
Tools and Techniques for biology			
THEORY: 5	**PRACTICAL:2**	**THEORY: 90**	**PRACTICAL:45**
MARKS			
THEORY: 100(30+70)		**PRACTICAL:34**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts related to structure and function of genes.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1-20	Principles and uses of analytical instrument -1 Balance (single and doublepen) .2 Ph meter .3 Colorimeter .4 Spectrophotometer. 5. Ultracentrifuge, 6. Molecular separation by chromatography (paper and thin layer column chromatography mono and two dimensions).
PUNIT-2 -20	Microscopy-1Principle of light transmission in light microscopy .2 Electron microscope (TEM and SEM), 3. Phase-contrast and 4. fluorescence microscope
UNIT -3 -10	Microbiological techniques .1 Media preparation. 2 Inoculation and growth monitoring Microbial assay. 3 Sterilization.4 Tissue culture Techniques.5Animal cell culture.
UNIT -4 -20	Cryotechniques –1 Cryopreservation of cell, tissue, organs .2 Electrophoresis. 3 Precipitation .4 Organelle separation by Centrifugation .5 Cell proliferation.
UNIT -5- -20	Immunological techniques- 1 Antigen antibody interactions .2 Surgical technique- Ovariectomy, Adrenalectomy .4 Indwelling catheters.

Reference

Boyer,R.(2000) Modern Experimental Biochemistry (3rd edition) Benjamin-Cumming.

Wilson,K.and Walker,J(2010) Experimental Biochemistry,Cambridge

Plummer, D.(2017) An Introduction to Practical Biochemistry(3rd edition) McGraw Hill

Paper- IV Research Methodology and Computer Application: Basics

Course outcome

After completing the course students will be able to demonstrate-

CO 01- Knowledge of research process reading evaluating developing and analyzing the ideas/ thought in critical/ analytical manner.

CO 02- literature reviews using print and online database of the subject and allied branches in perspectives of its inter -relation and so on.

CO 03- competent use of MLA and APA format for citation of print and electronic materials available.

CO 04- Potentials to identify explain, compare and prepare the key elements of research proposal and research report.

CO 05- Compare and contrast qualitative and quantitative research paradigms and to explain the use of each in research.

CO 06- The rationale for research ethics and importance of local processes for Institutional Review Board reviews for its rational improvisation.

CO 07- How Educational research contributes to the objectives of doctoral programme and specific career in higher education

CO 08- Competent use of information received in general social welfare and issues relevant and focused in the context of humanity as whole and its positive solutions in larger interest be devised.

Mapping of Programme and Course outcome

(Research Methodology and Computer Application: Basics)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO-1	Knowledge, understanding	✓							
PO-2	Critical Thinking	✓	✓					✓	
PO-3	Problem Solving						✓		✓
PO-4	Analytical Reasoning	✓		✓	✓	✓			✓
PO-5	Academic Knowledge		✓	✓	✓				
PO-6	Research Skill	✓	✓	✓	✓	✓	✓	✓	✓
PO-7	Business Skill							✓	
PO-8	Human Welfare	✓				✓		✓	✓
PO-9	Ethics Awareness	✓					✓		✓

COURSE CODE: 24 COURSE TYPE:OSC	**(M. Sc. -SECOND SEMESTER)**
COURSE TITLE:RESEARCH METHODOLOGY & COMPUTER APPLICATION: BASICS	
CREDIT: 06	**HOURS : 9**
MARKS : 100 **THEORY: 70 CCA : 30**	

OBJECTIVE:

- Understands the concept and place of research in concerned subject
- Gets acquainted with various resources for research
- Becomes familiar with various tools of research
- Gets conversant with sampling techniques, methods of research and techniques of analysis of data
- Achieves skills in various research writings
- Gets acquainted with computer Fundamentals and Office Software Package .

15 Hrs	**CONCEPT OF RESEARCH :** Meaning and characteristics of research , Steps in research process , Types of research - (i) Basic, applied and action research (ii) Quantitative and qualitative research , Areas of research in concern discipline **SELECTION OF PROBLEM FOR RESEARCH:** Sources of the selection of the problem, Criteria of the selection of the problem, Drafting a research proposal , Meaning and types of variables, Meaning and types of hypotheses.
15 Hrs	**TOOLS OF RESEARCH :** Meaning and general information about construction procedure of (i) Questionnaire, (ii) Interview, (iii) Psychological test, (iv) observation (v) Rating scale (vi) Attitute scale and (vii) check list , Advantages and disadvantages of above tools **SAMPLING :**Meaning of population and sample , Importance and characteristics of sample , Sampling techniques -i) Probability sampling : random sampling, stratified random sampling, systematic sampling, cluster sampling ii)Non-probability sampling: incidental sampling, purposive sampling, quata sampling
15 H rs	**METHODS OF RESEARCH:** Meaning and conducting procedure of following methods of research : Historical method, Survey method, Case study, Causal comparative method , Developmental methods , Experimental methods
15 Hrs	**TREATMENT OF DATA :** Level of measurements of data , Steps in treatment of data: editing, coding, classification, tabulation, analysis and interpretation of results **WRITING RESEARCH:** Abstract, Synopsis, Summary, Research Paper, Project, citation and Referencing.
	Computer Fundamentals-Computer System: Features, Basic Applications of Computer, Generations of computers. **Parts of Computer System :** Block Diagram of Computer System ; Central Processing Unit (CPU) ; Concepts and types of Hardware and Software, Input Devices - Mouse, Keyboard, Scanner, Bar Code Reader, track ball ; Output Devices - Monitor, Printer, Plotter, Speaker ; Computer Memory - primary and secondary memory, magnetic and optical storage devices. **Operating Systems - MS Windows:** Basics of Windows OS; Components of Windows - icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders; **Control panel:** display properties, adding and removing software and hardware, setting date and time, screensaver and appearance; **Windows Accessories:**

	Calculator, Notepad, WordPad, Paint Brush, Command Prompt, Windows Explorer.
15 Hrs	**Office Software Package: Word Processing - MS Word :**Creating, Saving, Opening, Editing, Formatting, Page Setup and printing Documents ; Using tables, pictures, and charts in Documents ; Using Mail Merge sending a document to a group of people and creating form, letters and label. **Spreadsheet - MS Excel:** Opening a Blank or New Workbook, entering data/Function/ Formula into worksheet cell, Saving, Editing, Formatting, Page Setup and printing Workbooks. **Presentation Software - MS Power Point:** Creating and enhancing a presentation, modifying a presentation, working with visual elements, adding Animations & Transitions and delivering a presentation.

M.Sc. II Semester Paper-V

Course ZOO ECC: Environmental and Forest laws

After successfully completing this course, the students will be able to :-

CO-0 1 Familiar with the laws, policies and institutions in the field of environment

CO-0 2 Acquire the skills needed for interpreting laws, policies and judicial decisions in a holistic perspective

CO-0 3 Acquire the ability to evaluate the role of law and policy in conservation and management of natural resources and prevention of pollution

CO-0 4 Examine different environmental management system and trade related intellectual properties.

CO-0 5 Evaluate the status of environmental education and public awareness along with their implications.

Mapping of Programme and Course outcome

(ENVIRONMENTAL AND FOREST LAWS)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓				
PO-2	Critical Thinking	✓	✓			✓
PO-3	Problem Solving		✓		✓	✓
PO-4	Analytical Reasoning		✓	✓		
PO-5	Academic Knowledge				✓	
PO-6	Research Skill		✓			
PO-7	Business Skill					
PO-8	Human Welfare	✓	✓	✓	✓	✓
PO-9	Ethics Awareness	✓	✓	✓	✓	✓

M.Sc. (ZOOLOGY)	**IIND SEMESTER**
COURSE CODE: ZOO	**COURSE TYPE: ECC/CB**
COURSE TITLE: **ENVIRONMENTAL AND FOREST LAWS**	
CREDIT:6	**HOURS:90**
THEORY: 100 (30+70)	**PRACTICAL:0**
OBJECTIVE: Analyze contrasting environmental regulatory methods and conceptual approaches including the common law, health and technology based statutes, and informational	

and economic approaches.	
UNIT-1 *-20 Hours*	International Environmental Laws: Evolution and development of International Environmental laws with reference to Stockholm Conference, Nairobi Declaration, Rio Conference, Rio+5 and the Rio+10, etc. Global environmental issues and International laws: to control Global warming, Ozone depletion, Acid rains, hazardous waste, CITES etc. Role of UN authorities in protection of Global Environment, Multinational authorities and agreements, future of International laws.
UNIT-2 *-25 Hours*	Environmental Acts, Rules and Notifications: The following environmental Acts/Rules will be discussed in details; the rest of the acts, rules and notifications will be referred to: a) Water (Prevention & Control of Pollution) Act and the corresponding Rule b) Water (Prevention & Control of Pollution) Cess Act and the corresponding Rule c) Air (Prevention & Control of Pollution) Act and the corresponding Rule d) Environment (Protection) Act and Rule e) Hazardous Waste (Management & Handling) Rules f) Manufacture, Storage and Import of Hazardous Chemicals Rules g) Public Liability Insurance Act and Rule
UNIT-3 *-10- Hours*	Environmental laws in India: Environmental Policy and laws. Constitutional and statutory laws in India: Doctrine Principles of State Policy, Fundamental Duties and Fundamental Rights and Panchayat Raj System. Statutory protection of the Human Environment: such as Indian Penal Code, Factories Act, Motor Vehicle Act, Hazardous Waste legislation for pollution abatement. Forest Policy-1952 and 1988, Forest Conservation Act-1980.
UNIT	Important Judgments and Cases: Discussion on landmark cases: Sriram Chemicals Oleum Leak Case, Bhopal Gas Leak case, Ganga Action Plan case etc. Green Benches.
UNIT-5 *-20-Hours*	Objectives of the Anti-pollution Acts. Institutional mechanism created under these acts and role and contribution in combining environmental pollution. The role of courts Requirements of Rule 14 for Environmental Audit under Environmental protection Act 1986 Rule & regulations & guidelines given for disposal of hazardous waste, municipal solid waste & bio-medical waste Framework: Rule & regulations of central & state Government and Central & State pollution control boards for Safeguard for Environmental Protection
SUGGESTED READINGS	1. *Environmental Laws* , Mhaskar A. K. 2. *Environmental Law & Policies In India*, Shyam Divan and Armin Rasencranz., Oxford University Press 3. *Environmental Protection & Law*, V. K. Prabhakar., Anmol Pubs. 4. *Handbook of Environmental Laws, Acts, Rules, Guidelines , Complaints & Standards.*, R. K. Trivedy, Enviro Media 5. *Environmental Pollution & Development* : Law & Policy, Chandra Pal., Mittal Pubs. 6. *Introduction to the Constitution of India*, Basu, D. D., Wadhwa and Company Law Publisher, New Delhi, 2003. 7. *Principles of International Environmental Laws,* Sands, P. Cambridge University Press, London, 2003. 8. *Environmental Legislation in India*, Choudhury, S.K., Oxford IBH, New Delhi, 1996.

	9. *Handbook of Environmental Laws, Acts, Guidelines, Compliance and Standards, Vol I & II,* B.S. Publications, Hyderabad, Trivedi, R.K.,2010.

M.Sc. II Semester Paper-V

Course ZOO (25) Evolution and Functional Anatomy of Fish

After successfully completing this course, the students will be able to:-

CO- 1 A detailed understanding of evolutionary strategies and morphological innovations, gene and genome duplication, evolutionary genetics, biogeographical distribution of major groups of fishes.

CO -2 An overview of adaptations of fishes to environmental extremes- temperature, pressure, stressors.

CO -3 Understanding growth and metabolism of fishes by regulation of food intake by neuropeptides and hormones, environmental factors and feed intake.

CO- 4 Evaluation of defense mechanism in fishes and their regulation.

CO- 5 Learning of fish reproduction for better yield in fish farming.

Mapping of Programme and Course outcome

(Evolution and Functional Anatomy of Fish Theory)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓				
PO-2	Critical Thinking		✓		✓	
PO-3	Problem Solving			✓	✓	
PO-4	Analytical Reasoning			✓		✓
PO-5	Academic Knowledge				✓	
PO-6	Research Skill			✓		
PO-7	Business Skill			✓		
PO-8	Human Welfare					✓
PO-9	Ethics Awareness					

M.Sc. (ZOOLOGY)	IIND SEMESTER
COURSE CODE: (25)	**COURSE TYPE: ECC/CB**
COURSE TITLE: **Evolution and Functional Anatomy of Fish Theory**	
THEORY: 100 (30+70)	**PRACTICAL:0**

OBJECTIVE: The main objective is to furnish the process of evolution, its importance and let the students know the functional anatomy of fish.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words**)**

UNIT -1 *-20 H*	1 Classification- evolutionary classification proposed by Berg and Romer . 2 Evolution and phylogeny-Agnatha and gnathostomata. 3 Elasmobranchii. 4 Holocephali . 5 Dipnoi .6 Teleostomi .
UNIT -2 *-15H*	1 Locomotion and migration in fishes . 2 Food and feeding habit and alimentary canal .3 Accessory respiratory organs in fishes .4 Swim bladder and weberianossicles.5 Heart and Blood vascular system in fishes .
UNIT- 3	1Excretion and osmoregulation .2 Nervous system. 3 Light producing in fishes.4 Electric production in fishes .5 Sound production in fishes .
UNIT-4 *-20 H*	1 Reproduction and development in fishes .2 Parental care in fishes .3Deep sea fishes . 4 Hill stream fishes 5 Marine fisheries .
UNIT-5- *15H*	Sense organ-1Photoreception 2 Chemoreception 3 Mechanoreception 4 Electrio reception .5 Fins and fishes .6 Skin and scale .
SUGGESTED READINGS	1. *Biology of Fishes*, Bone, Q. and Moore, R., Talyor and Francis Group, CRC Press, U.K. 2. *The Physiology of Fishes*, Evans, D. H. and Claiborne, J. D., Taylor and Francis Group, CRC Press, UK 3. *The Senses of Fish Adaptations for the Reception of Natural Stimuli*, von der Emde, R., Mogdans, J. and Kapoor, B. G., Narosa Publishing House, New Delhi, INDIA

M.Sc. II Semester Paper-V

Course ZOO ECC: Aquatic Resources and Their Conservation

After successfully completing this course, the students will be able to:-

CO 1 Learn classification of riverine fisheries and their hydrological conditions.

CO 2 A detailed understanding of cold water fisheries, biology of important cold water fishes of India For better production of fishes in extreme condition.

CO 3 Learning fishing techniques for localizing catches- remote sensing, sonar, radar; crafts and gears.

CO 4 An overview of post harvest technique to prevent fish spoilage for better preservation and quality control.

CO 5 Learning the management of aquatic pollution, waste management and fisheries extension services.

Mapping of Programme and Course out Come

(Aquatic Resources and Their Conservation)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓				
PO-2	Critical Thinking		✓			
PO-3	Problem Solving		✓			✓
PO-4	Analytical Reasoning	✓	✓	✓	✓	
PO-5	Academic Knowledge				✓	
PO-6	Research Skill		✓			✓
PO-7	Business Skill		✓			
PO-8	Human Welfare		✓	✓		✓
PO-9	Ethics Awareness			✓		✓

M.Sc. (ZOOLOGY)		IIND SEMESTER	
COURSE CODE: ZOO		**COURSE TYPE: ECC/CB**	
COURSE TITLE: **Aquatic Resources and Their Conservation**			
CREDIT:6		**HOURS:90**	
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL: 0**
THEORY:100(30+70)		**PRACTICAL: 0**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge, concepts related to aquatic resources and their conservation

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- *18 Hours*	Riverine fisheries- important river systems and their hydrological conditions, flora and fauna with special reference to fisheries, dams and their impact on riverine fisheries, fish ladders, interlinking of rivers and likely impact on fisheries. Cold water fisheries - ecology of hill streams, biology of important cold water fishes of India, recreational fishing. Lacustrine fisheries - origin of lakes and lake morphology, light, temperature and density relationship in the lacustrine ecosystems, heat energy and water movements, oxygen and other dissolved gases in lakes, pH and redox potential, fisheries profile and potential of major Indian lakes.
UNIT-2- *18Hours*	Estuarine fisheries- major estuarine systems of India, hydrography, flora and fauna with special reference to fisheries. Marine fisheries – coastal and deep sea fisheries, permanent and seasonal stratification, upwelling, the photic zone, control of primary production by light and nutrients availability, chemical properties of sea water, biology of important fishes (sardine, mackerel, tuna), marine protected areas.
UNIT-3- *18 Hours*	Integrated resources- coastal wet lands, mangroves, coral reefs, sea grasses and their conservation. Fishing techniques-- technologies for localizing catches- remote sensing, sonar, radar; crafts and gears. Stock assessment and management.
UNIT-4- *18 Hours*	Natural markers- morphological analyses, environmental signals, genetic analyses; Applied markers- marking and tagging, Stock identification data analysis - stock composition analysis, age and growth, fecundity estimation, application of statistical

	methods in fisheries. Fish conservation- fishing laws and regulation, permitting. Post harvest technology-- Fish spoilage, rigor mortis, rancidity, enzymatic spoilage, microbial spoilage; Fish preservation and processing- handling of fish at harvest/onboard, principles of fish preservations, methods of preservation, problems associated with fish preservations, quality control, fishery by-products.
UNIT-5- ***18 Hours***	Aquatic pollution- types and sources, impact of pollution on aquatic organisms, ecosystem analysis- bio-indicators, biomonitoring, environmental factors and fish health, xenobiotics. Waste management- national and international standards. Extension services - basic principles and emerging issues of extension, role of information and communication technology in fisheries extension.
SUGGESTED READINGS	1. *Computers in Fisheries Research*, Megrey, B. A. and Moksness, E. (2009), Springer, USA 2. *Biological Invasions in Marine Ecosystems Ecological, Management and Geographic Perspectives*. Rilov, G. and Jeffrey, A. C. (2009), Springer-Verlag, GERMANY 3. *Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research*, ICAR, (2006), DIPA, New Delhi, INDIA

M.Sc. II Semester Paper-V

Course ZOO ECC Aquaculture

After successfully completing this course, the students will be able to:-

CO -1 Learning aquaculture technology for fresh and marine fishes.

CO -2 Culturing of fish food organisms like algae; zooplankton for improving nutritive quality.

CO -3 Management of water quality requirements for aquaculture.

CO -4 Learning integrated farming by fish-cum-live stock farming, paddy-cum-fish farming, aquaculture engineering-aquahouse.

CO -5 A detailed learning of transportation of finfish and shellfish, eggs, fry, fingerlings and adults.

CO -6 Managing improvement in the Nutrition of aquatic animals by leaning feed types, manufacture And ingredients, anti- nutritional factors in fish feed ingredients.

CO -7 Understanding environmental impact of aquaculture, aquacultural wastes and future developments in waste minimization, environmental consequences of hyper nutrification.

CO -8 Learning about fish vaccines- strategy and use in aquaculture

Mapping of Programme and Course outcome

(Aquaculture)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO-1	Knowledge, understanding	✓							
PO-2	Critical Thinking		✓					✓	
PO-3	Problem Solving						✓		
PO-4	Analytical Reasoning			✓					✓
PO-5	Academic Knowledge				✓	✓	✓		
PO-6	Research Skill		✓					✓	✓
PO-7	Business Skill			✓	✓		✓	✓	✓
PO-8	Human Welfare					✓			
PO-9	Ethics Awareness								

M.Sc. (ZOOLOGY)	IIND SEMESTER
COURSE CODE:	**COURSE TYPE: ECC/CB**
COURSE TITLE: **Aquaculture**	
CREDIT:6	**HOURS:90**
THEORY: 100(30+70)	**PRACTICAL: 0**

OBJECTIVE: The purpose of this course is to make students understand Aquaculture. This knowledge is crucial for better development and management of aquaculture

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- *18 Hours*	Culture technology– freshwater (carps, catfishes, murrels, prawns), brackish water (asian sea-bass, milk fish, mullets, crabs, shrimps), mariculture (mussels, oysters, sea weeds), fish food organisms **(**algae; *Artemia*; zooplankton).
UNIT-2- *18 Hours*	Water Quality Requirements for Aquaculture- Role of temperature, pH, salinity, dissolved oxygen, ammonia, nitrite, nitrate, phosphate, Biological oxygen demand, Chemical oxygen demand. Integrated farming - fish-cum-live stock farming, paddy-cum-fish farming, aquaculture engineering- aquahouse, hatchery, ponds, race ways, recirculating system, cage, pen.
UNIT-3- *18 Hours*	Fish seed technology - natural collection, bundh breeding, induced breeding, cryopreservation of gametes. Transport of finfish and shellfish- transport of eggs, fry, fingerlings and adults. Nutrition of aquatic animals - nutritional requirements of commercially important finfish and shellfish, dietary requirements of larvae and brooders, feed types, manufacture and ingredients, anit- nutritional factors in fish feed ingredients and their treatments, use of attractants and growth stimulants in fish feeds, alternative protein sources in aquaculture diets, feeding techniques, role of probiotics in nutrition.
UNIT-4- *18 Hours*	Setting up of display aquarium- freshwater and marine aquaria, selection of compatible species, breeding of aquarium fishes. Role of genetics in aquaculture– gynogenesis, androgenesis, triploidy, tetraploidy, hybridization, sex reversal and

	breeding, production of transgenic fish, impact of GMOs on aquatic biodiversity.
UNIT-5- ***18 Hours***	Fish health- infection and diseases in fish, common fish pathogens, routes of pathogen entry in fish, methods of colonization and spread of pathogens, immune - evasion mechanisms of fish pathogens. Environmental impact of aquaculture- aquacultural wastes and future developments in waste minimization, environmental consequences of hypernutrification. Fish vaccines-strategy and use in aquaculture.
SUGGESTED READINGS	1. *Fishponds in Farming Systems*, Zijpp, V. D., Verreth, J. A. J., Tri, L. Q., van Mensvoort, M. E. F., Bosma, R. H., and Beveridge, M. C. M., Wageningen Academic Publishers, Netherlands. 2. *Aquaculture Principles and Practices*, Pillay, T. V. R., Blackwell Publishing, USA 3. *Aquaculture and Fisheries Biotechnology Genetic Approaches*, Dunham, R. A., CABI Publishing, USA.

M.Sc. Second semester

Practical work-I

Genetics-

-Study of mutant phenotypes of Drosophila. Study of law of independent assortment.

-Demonstration of sex-linkage by using white mutation of Drosophila.

-Preparation and study of Metaphage chromosomes from mouse bonemarrow.

- Study of Hardy-weinberg equibrium in human population by taking the example of blood group system (ABO).-

-Slide of chordate, Specimen of chorda

-Chromosome model. structure of DNA-Genetic disease related questions.-

-Biochemical test-protein ,chorbohydrade,fat .

Practical-II

Fish and Tools and Technique

-Water analysis .Dissection-Labeo, Catla, Scoliodon, Bird-head. Scale of fish. Fish identification. Slide of fish . Specimen of Fishes. Sepration of biomolecules by paper chromatography. Electrophoresis. Centrifuge apparatus .PH meter, Colorimeter estimation.

ACADEMIC PROGRAMMES & SCHEMES

M.Sc. (Zoology)THIRD SEMESTER (CBCS System)

Paper	Course Type	Course (Paper/Subjects)	Extern Exam	Cont. Int. Valuation				
			M M	Test	Seminar	Assig	Total	Total
III.	CCC-(31)	Animal Physiology (Vertebrates)	70	10	10	10	30	100
II.	CCC-(32)	Developmental biology	70	10	10	10	30	100
III	CCC-(33)	Immunology	70	10	10	10	30	100
IV	OSC-(34)	Intellectual Property, Human Rights and Environment: Basics	70	10	10	10	30	100
V	ECC	Tribal Studies	70	10	10	10	30	100
	ECC	Molecular Endocrinology and Reproduction-(Neuroendocrinology)	70	10	10	10	30	100
	ECC	Molecular Endocrinology and Reproduction-(Molecular Endocrinology)	70	10	10	10	30	100
	ECC-(35)	Endocrinology and reproduction	70	10	10	10	30	100
	Pra 1	Animal Physiology and Developmental Biology	100					100
	Pra 2	Immunology and Endocrinology	100					100
		Total						700

M.Sc. III SEMESTER ZOOLOGY

Course Code	Course Type	Course (Paper/Subjects)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)	
				L	T	P	Thy	P
ZOO 31	CCC	Animal Physiology (Vertebrates)	5	4	2	00	3	00
ZOO 32	CCC	Developmental Biology	5	4	2	00	3	00
ZOO33	CCC	Immunology	5	4	2	00	3	00
ZOO 34	OSC	Intellectual property, Human Rights and Environment: Basics	6	4	3	00	3	00
ZOO	ECC	Tribal Studies	6	4	2	00	3	00
ZOO	ECC	Molecular Endocrinology and Reproduction (Neuroendocrinology)						
ZOO	ECC	Molecular Endocrinology and Reproduction (Molecular Endocrinology)						
ZOO 35	ECC	Endocrinology and Reproduction						
Pra-I		Animal Physiology and Development biology	3			3		3
Pra-II		**Immunology and Endocrinology**	3			3		3
		Total	33					

M.Sc. ZOOLOGY III SEMESTER PAPER-I

Course ZOO (31) CCC: Animal Physiology (Vertebrates)

CO -1 After going through this course on 'Animal Physiology (Vertebrates)', the students have a good understanding of how vertebrate animals work.

CO -2 Students will be able to understand the biology of vertebrates which is influenced by the different environments of their niches.

CO -3 The students will be able to explore an original query in animal physiology.

CO -4 The students will appreciate evolutionary changes and environmental adaptations in different taxa of vertebrates.

CO- 5 Understand the physiology at cellular and system levels.

CO- 6 Learn the determination of heamoglobin content, blood groups and blood pressure.

Mapping of Programme and Course outcome

(Animal Physiology (vertebrates)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1	Knowledge, understanding	✓				✓	
PO-2	Critical Thinking		✓			✓	
PO-3	Problem Solving						
PO-4	Analytical Reasoning			✓			
PO-5	Academic Knowledge			✓	✓		
PO-6	Research Skill				✓		✓
PO-7	Business Skill						
PO-8	Human Welfare					✓	
PO-9	Ethics Awareness						

M.Sc. (ZOOLOGY)		IIIRD SEMESTER	
COURSE CODE: ZOO 31		**COURSE TYPE: CCC**	
COURSE TITLE: Animal Physiology (vertebrates)			
CREDIT:7		**HOURS:135**	
THEORY: 5	**PRACTICAL:2**	**THEORY: 90**	**PRACTICAL: 45**
THEORY: 100 (30+70)		**PRACTICAL:33**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge of comparative animal physiology. This knowledge is crucial for better development and management of comparative animal physiology.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- *15 Hours*	1 Internal Transport and Gas Exchange 2 Regulation of heart beat and blood pressure, 3 Neural and chemical regulation of respiration. 4 Respiratory pigment .5 Respiratory organ gill and Lung.
UNIT-2 -*20 Hours*	1 Regulation of body pH.2 General plan of circulation.3 Evolution of heart .4 Evolution of Aortic arches. 5 Physiology of heart .6 Cardiac cycle .7Blood coagulation.
UNIT-3- *15 Hours*	Osmoregulation- 1 Osmoregulation in aquatic and terrestrial environments. 2 Kidney functions and diversity 3 Extra-renal osmoregulatory organs .4 Patterns of nitrogen excretion. 5Thermoregulation - Heat balance in animals. 6Aestivation and hibernation. 7. Acclimation. 8 stress and hormones.
UNIT-4- *25 Hours*	Sensing the Environment-1 photoreception. 2 chemoreception 3 mechanoreception. echolocation, 4 biological rhythms .5 Chromatophores 6 bioluminescence.7 Nerve conduction .8 Pheromones.
UNIT-5- *15 Hours*	1 Feeding mechanisms and their control 2 effect of starvation .3 Muscle physiology – striated and smooth muscle .4 Adaptations of muscles for various activities.5 Neuronal control of muscle contraction 6 Electric organs.
SUGGESTED READINGS	1. General and Comparative Animal Physiology, Hoar W. S. (ed), Prentice Hall, India 2. Comparative Physiology (Handbook of Physiology): Vol. 1, 2, Dantzler, W.H. (ed.) Oxford University Press, New York, USA 3. Animal Physiology: Adaptation and Environmental, Nelson K. S. (ed) Cambridge University Press, Cambridge, UK

M.Sc. ZOOLOGY III SEMESTER

Course ZOO (32) CCC: Developmental Biology

After successfully completing this course, the students will be able to:

CO -1 Developmental Biology enquires about the fundamental processes that underpin the fertilization of an egg cell and its step-by-step transformation into the fascinating complexity of a whole organism.

CO -2 Students learn best by doing and by having the opportunity to put what they have learned into practice. Therefore, using various model organism as a learning tool in Developmental Biology.

CO -3 Students studying this course will be able to understand the structure and function of gametes like eggs and sperms.

CO- 4 their maintenance so the reproductive health in human and animals is maintained in good condition.

CO-5 This course will make them suitably knowledgeable to undertake the jobs in the assisted Reproductive technology clinics in the hospitals in addition to the teaching institutions.

M.Sc. III SEMESTER

Mapping of Programme and Course outcome

(Developmental Biology)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓				
PO-2	Critical Thinking	✓	✓	✓		
PO-3	Problem Solving		✓			
PO-4	Analytical Reasoning			✓		
PO-5	Academic Knowledge				✓	
PO-6	Research Skill				✓	
PO-7	Business Skill					
PO-8	Human Welfare					✓
PO-9	Ethics Awareness					✓

M.Sc. (ZOOLOGY)			**IIIRD SEMESTER**
COURSE CODE: ZOO 32			**COURSE TYPE: CCC**
COURSE TITLE: Developmental Biology			
THEORY: 5	**PRACTICAL:2**	**THEORY: 90**	**PRACTICAL: 45**
MARKS			
THEORY: 100(30+70)		**PRACTICAL: 33**	

OBJECTIVE: The purpose of the course is to make the students to understand developmental biology.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1 *18Hours*	Basic concepts of developmental biology-1 cell division 2 cell differentiation. 3 spontaneous and induced mutation .4 Leydig cell .5 Function and its regulation-Spermatogenesis .5 Oogenesis.
UNIT-2- *15 Hours*	Early embryonic development of vertebrates .1Structure of the gametes– the sperm and egg. 2 Pre Fertilization event. 3 post Fertilization event .4 Biochemistry of fertilization 5. Transgenic animals.
UNIT-3- *18*	1 Ovulation 2 Superovulation .3 Invitro oocyte maturation .4 Invitro fertilization 5 Embryo sexing and cloning .6 Cloning of animal by nuclear transfer .
UNIT-4- *18 Hours*	Postembryonic development: growth- 1 growth hormones .2 regeneration– epimorphic regeneration of reptile (salamander) limb. 3 Development of chick upto the formation of three germ layer .4 Extra embryonic membrane .5 Placentation .6 ICSI (Intra cytoplasmic sperm Injection). 7 GIFT (Gamete intra fallopian transfer).
UNIT-5- *18 Hours*	1 Embryonic stem cells 2 Genetic human syndromes .3 Collections and cryopreservation of gametes and Embryo. Permanent contraception methed-4 Surgical method .5 Hormonal methods.
SUGGESTED READINGS	1.*Developmental Biology*, Gilbert, (8th Ed., 2006) Sinauer Associates Inc., Massachusetts, USA. 2. *Principles of Development*, Wolpert, Beddington, Brockes, Jessell, Lawrence, Meyerowitz, (3rd Ed., 2006), Oxford University Press, New Delhi, INDIA. 3. *Analysis of Biological Development*, Kalthoff, (2nd Ed., 2000), McGraw-Hill Science, New Delhi, INDIA.

M.Sc. ZOOLOGY III SEMESTER

Course ZOO (33) CCC: Immunology

After successfully completing this course, the students will be able to:-

CO -1 The students will be able to identify the cellular and molecular basis of immune responsiveness and understand how the innate and adaptive immune responses coordinate to fight invading pathogens.

CO -2 Understand the immune modulatory strategies essential for generating or suppressing immune responses as required in hypersensitivity reactions.

CO -3 Learn to review the literature to determine the strengths and weaknesses of the data published in immunology and its novelty.

CO -4 Design new methods to improve existing vaccines and other immunotherapeutic strategies.

Mapping of Programme and Course outcome

(Immunology)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking	✓	✓		
PO-3	Problem Solving				
PO-4	Analytical Reasoning		✓	✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill			✓	✓
PO-7	Business Skill				
PO-8	Human Welfare				✓
PO-9	Ethics Awareness				

M.Sc. (ZOOLOGY)		IIIRD SEMESTER	
COURSE CODE: ZOO 33		**COURSE TYPE: CCC**	
COURSE TITLE: Immunology			
CREDIT:7		**HOURS:135**	
THEORY: 5	**PRACTICAL:2**	**THEORY: 90**	**PRACTICAL: 45**
THEORY:100(30+70)		**PRACTICAL : 34**	

OBJECTIVE: This course is aimed towards generating fundamental knowledge concept related to immunology.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- 30 Hours	Overview of the immune system:1 components of the immune system 2 Immune system involved cell - T Lymphocyte and B Lymphocyte 3.Types of Antibodies- Natural antibodies and Acquired antibodies .
UNIT-2- *10 Hours*	1Antegen (character and types) .2 Structure and function of specific Immunoglobulins 3. Antigen antibody reaction- Precipitation, Nutrilization, Osponisation, Phagocytosis 4. Structure and of function MHC complex
UNIT- 3- *15 Hours*	1 Cell of Immune system 2 Organ of Immune system .3 Mechanism of Cell mediated Immunity .4 Humoral Immunity 5 Monoclonal Antibody.
UNIT- 4- *20 Hours*	Immune response – 1 Properties of cytokines .2 Complement system .3 Vaccines .4 Hematopoiesis 5 NK cell (natural killer cell) 5 Agglutination reaction .
UNIT -5- *15 Hours*	1 Innate or natural Immunity 2 Acquired Immunity .3 Hypersensitivity 4 Acquired immune deficiency syndrome.
UGGESTED READINGS	1. Kuby Immunology, Richard, Thomas, Barbara, Janis, (5th Ed., 2003), W. H. Freeman and company, New York, USA. 2. Immuno Biology- The immune system in health and disease, Janeway, Travers, Walport and Shlomchik, (6th Ed., 2005), Garland Science Publishing, New York, USA. 3. Immunology, David, Brostoff and Roitt, (7th Ed., 2006), Mosby & Elsevier Publishing, Canada, USA.

M.Sc. III SEMESTER

Course ZOO (34) OSC: Intellectual property, Human rights and Environment

After successfully completing this course, the students will be able to:-

CO 1 Students will be able to analyze different types of intellectual property rights in general and protection of products derived from research and issues related to application and obtaining patents

CO 2 Understand the concept of IPR.

CO 3 The present course gives a detailed account of intellectual property right, its genesis and scope, the steps involved in submitting and publication of patent, trademark and copyright rules.

CO 4 Examine various legal issues related to IPR

Mapping of Programme and Course outcome

(Intellectual property, Human rights and Environment)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓		
PO-3	Problem Solving				
PO-4	Analytical Reasoning			✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill	✓		✓	✓
PO-7	Business Skill		✓		
PO-8	Human Welfare		✓	✓	✓
PO-9	Ethics Awareness		✓	✓	✓

M.Sc. (ZOOLOGY)		IIIRD SEMESTER	
COURSE CODE: 34		**COURSE TYPE:OSC**	
Course title-Intellectual Property Rights, Human Rights & Environment: Basics			
CREDIT: 6		**HOURS:90**	
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL: 0**
THEORY:100(30+70)		**THEORY: 100**	

OBJECTIVE: To understand the nature of tribal problems and difficulties in the Development of tribal areas.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- *18Hours*	• Patents-Introduction &Concepts, Historical Overview. • Subject matter of patent. • Kinds of Patents. • Development of Law of Patents through international treaties and conventions including TRIPS Agreement. • Procedure for grant of patents &term of Patent. • Surrender, revocation and restoration of patent. • Rights and obligation of Patentee. • Grant of compulsory licenses. • Infringement of Patent and legal remedies. • Offences and penalties. • Discussion on leading cases.
UNIT-2- *-18 Hours*	• Meaning of Copyright, Historical Evolution. • Subject matter of copyright. • Literary works. • Dramatic works &Musical works. • Computer Programme. • Cinematographic films. • Registration of Copyrights. • Term of Copyright and Ownership of Copyrights. • Neighboring Rights.

	• Rights of Performers &Broadcasters. • Assignment of Copyright. • Author's Special Rights(Moral Rights) • Infringement of Copyrights and defenses. • Remedies against infringement(Jurisdiction of Courts and penalties) • International Conventions including TRIPS Agreement WIPO, UCC, Paris Union, Berne Convention, UNESCO. • Discussion on leading cases.
UNIT-3- ***18 Hours***	• Human Rights-Meaning & Essentials. • Human Rights Kinds. • Right related to Life, Liberty, Equals & Disable**.**
UNIT-4- ***18 Hours***	• National Human Rights Commission. • State Human Rights Commission. • High Court. • Regional Court. • Procedure & Functions of High & Regional Court.
UNIT-5- ***18 Hours***	• Human Right and Environment: Introduction to basic concepts in human health and disease. including the fundamentals of environmentally and occupationally induced illness. Case studies-Chernobyl nuclear Accident, Bhopal gas release tragedy.
SUGGESTED READINGS	1.G.B. Reddy,Intellectual Property Rights and Law Agency,Hyderabad.2.S.R. Myneni,Intellectual Property Law,Eastern Law House,Calcutta.3. P Narayanan Intellectual Property Rights and Law(1999) Bharat Law House,New Delhi.5.Comish W.R.Intellectual Property.3rd (1996),Sweet and Maxwell.6.P.S. Sangal and Kishor Singh,Indian Patents,system and paris Convention.7. Comish W.R.Intellectual Property,Patents,Copyrights and allied right(2005) 8.Bibeck debroy,Intellectual property right(1998),Rajiv Gandhi foundation.

M.Sc. III SEMESTER

Course ZOO ECC: Tribal Studies

After successfully completing this course, the students will be able to:-

CO -1 Understand the tribal culture, life and their situation in India.

CO -2 Know about the Tribal development in India from Pre-independence to Present-day

CO -3 Develop zeal to work for tribal people and their development in different departments of Government and non-governmental organizations.

Mapping of Programme and Course outcome

(Tribal Studies)

		CO-1	CO-2	CO-3
PO-1	Knowledge, understanding	✓		
PO-2	Critical Thinking		✓	✓
PO-3	Problem Solving			
PO-4	Analytical Reasoning		✓	✓
PO-5	Academic Knowledge		✓	
PO-6	Research Skill			✓
PO-7	Business Skill			
PO-8	Human Welfare		✓	✓
PO-9	Ethics Awareness		✓	✓

M.Sc. (ZOOLOGY)		IIIRD SEMESTER	
COURSE CODE: ZOO		**COURSE TYPE: ECC/CB**	
COURSE TITLE: **TRIBAL STUDIES**			
CREDIT: 6		**HOURS:90**	
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL: 0**
MARKS			
THEORY:100(30+70)		**THEORY: 100**	

OBJECTIVE: To understand the nature of tribal problems and difficulties in the Development of tribal areas.

Scheme of marks:

(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)

(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)

(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- *18Hours*	**Tribal Studies :** Meaning, Nature, Scope, Need & importance of tribal studies. Meaning, Definition & characteristics of Tribe, Caste & Race
UNIT-2- *-18 Hours*	**Scheduled Tribe in India :** Population Composition of tribal, classification of Indian Tribe – Racial, Lingual, Geographical, Cultural. **Some Major Tribes in India :** Santhal, Khasi, Munda, Bhils. **Some Major Tribes in Central India :** Gond, Baiga, Bharia, Korkus.
UNIT-3- *18 Hours*	**Illiteracy :**Poverty, Indebt ness, Unemployment, migration & Exploitation Environmental & Degradation. **Problem of Health and sanitation :** Prostitution, Culture Decay due to assimilation. Replacement & Rehabilitation of Tribal population.
UNIT-4- *18 Hours*	**Welfare-Concept, Characteristics:** Tribal Welfare in post independence period. Constitutional provision & safe guard after independence, Legislation & Reservation Policy.
UNIT-5- *18 Hours*	**Tribal Development Programs for Scheduled Tribes :** Medical, Education, Economy, Employment & Agriculture Evaluation of Programs **Tribal Welfare & Advisory Agencies in India :** Role of NGO's in tribal development, Role of Christian missionaries in tribal welfare & development. Tribal Welfare Administration.
SUGGESTED READINGS	1. *Tribal Development In India (Orissa)* by Dr. Taradutt 2. *Books on Tribal studies* by PK Bhowmik 3. *Books on 'Tribal Studies'* by W.G. Archer

M.Sc. III SEMESTER

Course ZOO ECC: Molecular Endocrinology and Reproduction (Neuroendocrinology)

After successfully completing this course, the students will be able to:-

CO -1 Understand the basic organization of the vertebrate brain, and the interaction of hypothalamus with the pituitary and pineal gland.

CO -2 Learn basic principles of important techniques applied to neuroendocrine research.

CO -3 Understand neuroendocrine regulation of physiological processes.

CO -4 Develop the ability of critical thinking of regulatory biology in animals.

Mapping of Programme and Course outcome (Molecular Endocrinology and Reproduction- (Neuroendocrinology)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓		✓
PO-3	Problem Solving			✓	
PO-4	Analytical Reasoning			✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill		✓		✓
PO-7	Business Skill				
PO-8	Human Welfare	✓			
PO-9	Ethics Awareness				

M.Sc. (ZOOLOGY)			**IIIRD SEMESTER**	
COURSE CODE: ZOO			**COURSE TYPE: ECC/CB**	
COURSE TITLE: **Molecular Endocrinology and Reproduction- (Neuroendocrinology)**				
CREDIT:6			**HOURS:90**	
THEORY: 6	**PRACTICAL:0**		**THEORY: 90**	**PRACTICAL:0**
THEORY:100(30+70)			**PRACTICAL: 0**	
OBJECTIVE: The purpose of the course is to make the students to understand molecular endocrinology and reproduction neuroendocrinology.Scheme of marks: (i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words) (ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words) (iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)				
UNIT-1- *18 Hours*	General organization of neuroendocrine organs and nervous system. Neuroanatomy: form, varieties and distribution of neurons; Structural characteristics of neurons; Stereotaxic atlas of rat brain and the hypothalamus. Neurophysiology: electrical properties of neurons and propagation of nerve impulses; Synapse: types, structure and function. Neurotransmitter and its release; Neuromodulation:			
UNIT-2 -*18 Hours*	Neurotransmitter vs neuropeptides, Synaptic transmission: role of G-protein coupled, glutamate and on-channel linked receptors; GABA/glutamate neurons in adult preoptic area: sexual dimorphism and function.			
UNIT-3- *18 Hours*	The hypothalamo- hypophysial axis. Hypothalamo- vascular system. Hormones from hypothalamus: chemistry and physiology of releasing and release inhibiting hormones; Regulation of hypothalamic hormone secretion. Hypothalamo- hypophysial interactions with the gonads, adrenal and other endocrine organs. Diversity of ovarian steroid signaling in the hypothalamus. Development and cytology of pituitary gland. Regulation of pituitary hormone secretion. Neurohypophysis: synthesis and storage of oxytocin and vasopressin; Regulation of the release of neurohypophyseal hormones. Concepts of feed-back inhibition and feed-forward activation.			
UNIT-4- *18 Hours*	Regulation of the expression of POMC-related peptides and their differential expression in brain and pituitary. Environment and reproduction. Endocrine disruptors; Embryonic diapauses and other adaptive mechanisms. Biological clock and the pineal: synthesis and regulation of melatonin, phylogeny of pinealocytes, role of pineal in circadian rhythms, regulation of pineal by SCN and vice versa, physiological actions of melatonin,			

	biological clock and clock gene expression, fluoride and pineal.
UNIT-5- ***18 Hours***	Neuroendocrine regulation of immune system; Stress hormones and immune responses; Regulation of systemic homeostasis by nervous and immune system interactions. Melatonin, immune responses and cancer therapy. Neuroendocrine disorders: genetic versus environmental cause. Principles and application of techniques: electrophysiology, immunocytochemistry, *in situ* hybridization, autoradiography, in vitro perfusion
SUGGESTED READINGS	1.An Introduction to Neuroendocrinology, Brown R., (1994), Cambridge University Press, Cambridge, UK 2. Psychoneuroimmunology, , Ader R, Felten D.L. and edited by Nicholas C. (4th Ed., 2007), Academic Press, UK 3. Endocrinology (3 volumes set), *DeGroot* L. J. and Jameson J.L., Editors, (5th Ed., 2006), Saunders Elsevier Press, USA.

M.Sc. III SEMESTER

ZOO ECC: Molecular Endocrinology and Reproduction (Molecular Endocrinology)

CO -1 Students of this class will be able to understand the importance of hormones in the maintenance of reproductive health in human and animals.

CO -2 This course will make them suitably knowledgeable to undertake the therapeutic research jobs in various pharmaceutical companies as well as in hospitals in addition to the IVF centers.

CO- 3 The course envisages information on endocrine system with emphasis on the structure of hypothalamus and pituitary.

CO- 4 The associated hormones and the related disorders will be explained.

CO- 5 Understand the mechanism of hormone action.

Mapping of Programme and Course outcome (Molecular Endocrinology and Reproduction)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓				
PO-2	Critical Thinking		✓			✓
PO-3	Problem Solving		✓			
PO-4	Analytical Reasoning			✓		
PO-5	Academic Knowledge				✓	
PO-6	Research Skill		✓	✓		
PO-7	Business Skill					
PO-8	Human Welfare		✓	✓		✓
PO-9	Ethics Awareness		✓			

M.Sc. (ZOOLOGY)		IIIRD SEMESTER	
COURSE CODE: ZOO		**COURSE TYPE: ECC/CB**	
COURSE TITLE: Molecular Endocrinology and Reproduction-(Molecular Endocrinology)			
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL: 0**
THEORY: 100 (30+70)		**PRACTICAL:0**	

OBJECTIVE: The purpose of the course is to make the students to understand molecular endocrinology and reproduction neuroendocrinology.
(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)
(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)
(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1- *15 Hours*	Discovery of hormones as chemical signals for control and regulation of physiological processes. Nature of hormonal actions. Major questions in biology of hormones. Techniques for quantitation of hormones. Design and development of hormonal assays.
UNIT-2- *20 Hours*	Structure of peptide and protein hormones. Purification and characterization of hormones. Structure-Function relationships in different hormones. Phylogenic analysis of hormonal structures and functions. Biosynthesis of protein hormones. Storage and secretion of hormones: molecular mechanisms of regulation.
UNIT-3- *20*	Transcriptional and post-transcriptional mechanisms of hormone biosynthesis and secretion. Regulation of biosynthesis and secretion. Inhibitors of hormone biosynthesis and their use.
UNIT-4- *15 Hours*	Nature of hormonal effects and actions. Discovery of receptors in target tissues. Mechanisms of hormone action and signal attenuation. Signal discrimination, signal transduction and signal amplification in hormone regulated physiological processes. Structural requirements for successful hormone-receptor interactions. Receptor antagonists and their applications. Metabolism of hormones by target and non-target tissues. Pharmacokinetics of hormones. Hormones and behavior- cellular and molecular actions of semiochemicals.
UNIT-5 *-20 Hours*	Hormones as therapeutic agents. Current developments in design and production of hormonal contraceptives. Recombinant protein hormones-production and application in regulation of fertility in farm animals and humans. Evolution of chemical communication in animal systems. Unsolved problems in hormonal biology.
SUGGESTED READING	1.Peer reviewed journal articles, monographs and reviews as and when recommended. 2. Molecular Biology of Steroid and Nuclear Hormone receptors, ed. Freedman L. P., (1998), Birkhauser, Boston, USA 3. Biochemical actions of hormones, ed. Litwack, G. (1985), Academic press, New York, USA

M.Sc. ZOOLOGY SEMESTER III PAPER-V

Course ZOO ECC (35): Endocrinology and reproduction

After successfully completing this course, the students will be able to:

CO -1 Understand endocrine system and the basic properties of hormones.

CO – 2 Appreciate the importance of endocrine system and the crucial role it plays along with the Nervous system in maintenance of homeostasis.

CO -3 Gain insight into the molecular mechanism of hormone action and its regulation.

CO -4 Know the regulation of physiological process by the endocrine system and its implication in diseases.

CO -5 Gain knowledge about the prevalent endocrine disorders and critically analyze their own and their family`s health issues.

Mapping of Programme and Course outcome

(Endocrinology and reproduction)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓				
PO-2	Critical Thinking		✓			
PO-3	Problem Solving					✓
PO-4	Analytical Reasoning			✓		
PO-5	Academic Knowledge				✓	
PO-6	Research Skill					✓
PO-7	Business Skill					
PO-8	Human Welfare				✓	✓
PO-9	Ethics Awareness					

M.Sc. (ZOOLOGY)		**IIIRD SEMESTER**	
COURSE CODE: ZOO 35		**COURSE TYPE: ECC**	
COURSE TITLE: **Endocrinology and reproduction**			
CREDIT:		**HOURS:90**	
THEORY: 100(30+70)	**PRACTICAL: 0**	**THEORY: 90**	**PRACTICAL:0**
MARKS			
THEORY: 100 (30+70)		**PRACTICAL:0**	

Scheme of marks:
(i)short Answer type questions:- three questions carrying 5 marks each to be asked two to be attempted (word limit 100 words)
(ii)Middle Answer type question:-three question carrying 9 marks each to be set two to be attempted.(word Limit 250 words)
(iii)Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted.(word limit 750 words)

UNIT-1-	**1Aims and scope of Endocrinology 2 Discovery of hormone . 3 classification of hormones. 4 Hormones as a messengers. 5 Neuro endocrine system. 6 Nature of hormone action.**
UNIT-2- *18 Hour*	**1 Hormones and Homeostasis. Hormonal regulation of -2 carbohydrate metabolism 3 Nitrogen metabolism 4 lipid metabolism . 5 Metabolism of hormones.**
UNIT-3- *18 Hours*	**Biosynthesis and secretion of hormones- 1 Biosynthesis of steroid hormones Biosynthesis and amino acid derived small size hormone - 2 T4 hormone 3 epinephrine .4 Biosynthesis of simple peptide hormones .**
UNIT-4- *18 Hour*	**Structure function of -1 Pituitary gland .2 thyroid gland . 3 Parathyroid gland. 4 Adrenal gland .5 Thymus gland.**
UNIT-5- *18 Hour*	**1 Hormonal control of reproduction. 2 Endocrine disorder due to hormones .3 Hormonal control of metamorphosis .4 Hormones and Behaviour . 5 Pancreas and Hormone. 6. Seasonal breeder 6 Continuous breeders.**
SUGGESTED READINGS	**1.An Introduction to Neuroendocrinology, Brown R., (1994), Cambridge University Press, Cambridge, UK** **2. Psychoneuroimmunology, , Ader R, Felten D.L. and edited by Nicholas C. (4th Ed., 2007), Academic Press, UK** **3. Endocrinology (3 volumes set), *DeGroot* L. J. and Jameson J.L., Editors, (5th Ed., 2006), Saunders Elsevier Press, USA.**

M. Sc. Third semester

Practical/Lab work-I
Animal Physiology and Developmental biology

-Slide of vertebrate.
Specimen of Chordata.
Use of Kymograph. Dissection of rat, chick head.
Larval form of Invertebrates.
Stethoscope. ECG.
Slide of chick embryo
Blastodisc demonstration.
Study of regeneration in Hydra.

Practical-II
Immunology and Endocrinology

–Study of Antigen-antibody in blood.
Endocrine gland in cockroach.
Study of Hormones and behavior .
RBC counting. WBC counting. Blood group test . Use of Haemoglobenometer. Haemin crystal.
Dissection of primary and secondary immune organs from mice.
Preparation of single cell suspension from bone marrow and spleen (splenocytes) of mice .Study of different types of Hormones.
Dissection and demonstrate of different Endocrine gland in Invertebrate .

ACADEMIC PROGRAMMES & SCHEMES

M.Sc. (Zoology)

FOURTH SEMESTER (CBCS System)

Paper	Course Type	Course (Paper/Subjects)	External Written Test	Cont. Int. Valuation				
			Max. Marks	W. test	Seminar	Assig	Total	Grand Total
I.	CCC-41	Animal Behavior	70	10	10	10	30	100
II.	CCC-42	Biology of Parasitism	70	10	10	10	30	100
III	CCC-43	Molecular Cell Biology	70	10	10	10	30	100
IV	SSC/PRJ-44	Dissertation	70	10	10	10	30	100
V	ECC	Genomics ,Metagenomics and Epigenetics-Genomics	70	10	10	10	30	100
	ECC	Metagenomics-Epigenetics-Chromatin Biology						
	ECC	Bio Molecules and Metabolic Regulation						
	ECC-45	Population Genetics ,Evolution and Genetic variability						
Pra	Pra-I	Animal Behavior and Parasitism	100					100
	Pra-II	Cell biology and Endocrine Physiology, Genomics	100					100
		Total	700					700

M.Sc. ZOOLOGY FOURTH SEMESTER

Course Code	Course Type	Course (Paper/Subjects)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)	
				L	T	P	Thy	P
ZOO 41	CCC	Animal Behavior	6	4	2	00	3	00
ZOO 42	CCC	Biology of Parasitism	6	4	2	00	3	00
ZOO 43	CCC	Molecular Cell Biology	6	4	2	00	3	00
ZOO 44	OSC	Dissertation	6	4	3	3	3	00
ZOO	ECC	Genomics, Metagenomics and Epigenetics- Genomics	6	4	3	3	3	
ZOO	ECC	Metagenomics - Epigenetics- Chromatin Biology						
ZOO 45	ECC	Bio Molecules and Metabolic Regulation						
ZOO	ECC/CB	Population Genetics, Evolution and Genetic Variability						
Pra-	Pra-I	Animal Behavior and Parasitism	3					3
	Pra-II	Cell Biology and Endocrine Physiology, Genomics	3					3
MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN TOTAL IT WOULD BE 30			TOTAL= 36					

M.Sc. V SEMESTER

Course ZOO (41) CCC: Animal Behavior

After successfully completing this course, the students will be able to:

CO -1 Learn a wide range of theoretical and practical techniques used to study animal behaviour.

CO -2 Demonstrate ability to communicate scientific information in both oral and written formats.

CO -3 Demonstrate knowledge of key concepts in animal behavior.

CO -4 Exhibit quantitative research skills (or demonstrate ability to perform all parts of the scientific method)

CO -5 Demonstrate ability to think flexibly and apply knowledge to new problem.

Mapping of Programme and Course outcome

(Animal Behavior)

		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	Knowledge, understanding	✓	✓			
PO-2	Critical Thinking		✓			
PO-3	Problem Solving					✓
PO-4	Analytical Reasoning	✓		✓		
PO-5	Academic Knowledge				✓	
PO-6	Research Skill		✓		✓	
PO-7	Business Skill					
PO-8	Human Welfare					
PO-9	Ethics Awareness					

M.Sc. (ZOOLOGY) SEMESTER		**IVTH**	
COURSE CODE: ZOO 41		**COURSE TYPE: CCC**	
COURSE TITLE: Animal Behavior			
CREDIT:7		**HOURS:135**	
THEORY: 5	**PRACTICAL:2**	**THEORY: 90**	**PRACTICAL: 45**
THEORY: 100(30+70)		**PRACTICAL:33**	
OBJECTIVE: The purpose of the course is to make the students to understand about the animal behavior			
-18 Hours	1Introduction to the study of animal behavior .2 Branches of Ethnology history. Concept of Ethnology -3 Concept of Motivation 4 Concept of fixed action Pattern. 5 Concept of sign or Key Stimulus or releaser .6 Concept of innate releasing mechanism.		
18 Hours	1 Concepts of learning .2 Concept of imprinting .3 Concepts of behavioral genetics. 4 Method of Studying behavior.5 Reflex action .6 Conditioning habitation .7 Innate behavior .		
18 Hours	1 Mammalian nervous system-structure and function brain .2 Neural mechanism of Learning .3 Role of hypothalamus in feeding 4, drinking and reproduction .5 Pheromones in Invertebrates .6 Scent marking in Vertebrates.		
18 Hours	1 Biological rhythms .2 Hormones and behavior.3 Biological clocks .4 Orientation .5 Social organization in honey Bee .6 Social behavior in Primates.		
18 Ho	1 Reproductive behavior .2 Parental behavior. 3 Bird migration and navigation. 4 Fish migration and navigation .5 Communication.		
	1. *Mechanism of Animal Behavior*, Peter Marled and J. Hamilton; John Wiley & Sons, USA 2 *Animal Behavior*, David McFarland, Pitman Publishing Limited, London, UK 3 *Animal Behavior*, John Adcock, Sinecure Associate Inc., USA 4 *Perspective on Animal Behavior*, Goodenough, McGuire and Wallace, John Wiley & Sons, USA 5 *Exploring Animal Behavior*, Paul W. Sherman & John Alcock, Sinauer Associate Inc. ,Massachusetts, USA 6 *An Introduction to Animal Behavior*		

Course ZOO (42) CCC: Biology of Parasitism

After successfully completing this course, the students will be able to:

CO -1 Understand the biology behind host-parasite interactions.

CO -2 Learn about epidemiological concepts of parasitic infections of global importance.

CO -3 Trained to diagnose, identify and detect some important parasites.

CO -4 Learn pathological changes associated with parasite infections.

CO -5 discuss the role of vectors and intermediate hosts in parasite transmission.

CO -6 Learn the role of vertebrate innate and adaptive immune system in controlling parasites.

CO - 7Learn molecular biology concepts unique to parasite infections.

CO -8 Define the biochemical targets of drugs targeting parasites.

Mapping of Programme and Course outcome

(Biology of Parasitism)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO-1	Knowledge, understanding	✓							
PO-2	Critical Thinking		✓					✓	
PO-3	Problem Solving								
PO-4	Analytical Reasoning			✓					✓
PO-5	Academic Knowledge				✓				
PO-6	Research Skill			✓		✓	✓		
PO-7	Business Skill								
PO-8	Human Welfare				✓	✓			✓
PO-9	Ethics Awareness								

M.Sc. (ZOOLOGY)			IVTH SEMESTER
COURSE CODE: ZOO 42			COURSE TYPE: CCC
COURSE TITLE: Biology of Parasitism			
CREDIT:7		HOURS:135	
THEORY: 5	PRACTICAL:2	THEORY: 90	PRACTICAL:45
MARKS			
THEORY:100(30+70)		PRACTICAL:33	

OBJECTIVE: The purpose of the course is to make the students to understand biology of parasitism

18 Hours	1 General organization and classification of parasitic protozoa .2 Morphology, Life cycle, Mode of infection- Endameba.3 Morphology, Life cycle mode of infection -Trypanosome . 4 Morphology, Life cycle in Giardia .6 Life cycle and infection of plasmodium.
18 Hours	1 Gastro intestinal nematodes-Ascaris.2 Morphology life cycle in Wuchereia. 3 Morphology life cycle in Ancylostoma .4 Life cycle of Enterobius vermicularis .5 Trichinella .6 Dracanculus.
18 Hours	1 General organigation and classification parasitic Cestodes.2. Life cycle of Parasitic Fasciola hepatica. Viral disease- 3 AIDS.4 Rabbis .4 Plague 5 Small pox.
18 Hours	Bacterial disease -1 Tuberculosis .2 Leprosy .3 Fungal diseases – Mycosis .4 Reproduction in bacteria (Asexual and Sexual) 5 Life cycle and infection –Leismania.
18 Hours	Diseases transmitted by Insects and Ticks- 1 Sleeping sickness .2 Malaria 3 Rickettesiae .4 Plant parasite nematods. 5 Gastro intestinal Helminthes – biology and life cycle Systosoma.
Suggested readings	1. Foundations of Parasitology, Roberts L.S. and Janovy J., McGraw-Hill Publishers, New York, USA. 2. Modern Parasitology: A Textbook of Parasitology, FEG Cox., Wiley-Blackwell, U. K.

M.Sc. (ZOOLOGY)		**IVTH SEMESTER**	
COURSE CODE: ZOO 43		**COURSE TYPE: CCC**	
COURSE TITLE: Molecular **Cell Biology**			
CREDIT:7		**HOURS:135**	
THEORY: 5	**PRACTICAL:2**	**THEORY: 90**	**PRACTICAL:45**
THEORY: 100(30+70)		**PRACTICAL:0**	
OBJECTIVE: The purpose of the course is to make the students to understand Endocrine physiology			
18 Hours	1 Biomembrane- Molecular composition, arrangement and function .2 Membrane Models .3 Cell permeability diffusion ,active transport and pump(uniport, Symport, Antiports) 4 Microfilament and microtubules structure and dynamics .		
18 Hours	1 Microtubule and Mitosis .2 Cillia and flagella . 3 Cell Movement intracellular transport role and Kinesin and dynein ,single transduction mechanism .4 Cell cell signaling –cell surface receptors and second messenger system .5 Signaling from plasma membrane to nucleus .		
18 Hours	Cell cell adhesion and communication-1 Ca++ dependent homophile cell cell adhesion .2 Ca++ independent homophile cell cell adhesion. Cell matrix adhesion -3 Integrins .4 Callogen.		
18 Hours	Genome organization -1 Chromosome morphological structure and types .2 Nucleus with reference to nucleolus .3 Chromosomal organization of gene and nucleosome .4 Uptake into Endoplasmic reticulum 5 Protein synthesis free and bound Polysomes .		
18 Hours	1 Biogenesis of mitochondria and nuclei .2 Trafficking mechanisms. 3 Biology of cancer .4 Biology of aging 5 Apoptosis- definition, mechanism and significance .		

M.Sc. IV SEMESTER

Course ZOO-SSC/PR J-44: Dissertation

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

CO -1 Designing of research work.

CO -2 Formulation of research methodology.

CO -3 Methods implementation and gathering of research data and application of statistics**.**

CO -4 Research result formulation and interpretation.

Mapping of Programme and Course outcome

(Dissertation)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓		
PO-3	Problem Solving				
PO-4	Analytical Reasoning	✓		✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill	✓	✓	✓	✓
PO-7	Business Skill				
PO-8	Human Welfare	✓	✓	✓	✓
PO-9	Ethics Awareness				

<table>
<tr><td colspan="4">M.Sc. (ZOOLOGY) IVTH SEMESTER</td></tr>
<tr><td colspan="4">COURSE CODE: ZOO 44 COURSE TYPE: SSC/PRJ</td></tr>
<tr><td colspan="4">COURSE TITLE: DISSERTATION</td></tr>
<tr><td colspan="2">CREDIT:6</td><td colspan="2">HOURS: 135</td></tr>
<tr><td>THEORY: 0</td><td>PRACTICAL:6</td><td>THEORY: 0</td><td>PRACTICAL:135</td></tr>
<tr><td colspan="4">MARKS: 100</td></tr>
<tr><td colspan="2">THEORY: 0</td><td colspan="2">PRACTICAL:100 (50+50)</td></tr>
<tr><td colspan="4">OBJECTIVE: The main objective of Self Study Course is to enable the students to learn on their own as well development of skill related to research and developmental activities.</td></tr>
<tr><td colspan="4">Course Report Submission: 50 marks
Viva Voce: 50 marks</td></tr>
</table>

M.Sc. ZOOLOGY SEMESTER IV

Course ZOO ECC: Genomics, Metagenomics and Epigenetics-Genomics

CO -1 After successful completion of the course the student will be able to design and comprehend experimental strategies for whole genome, transcriptome and proteome analysis.

CO- 2 The student should be able to appropriately access and utilize various online and offline tools and databases related to genomic analysis.

CO -3 To understand and find cures for diseases.

Mapping of Programme and Course outcome)

(Genomics, Metagenomics and Epigenetics- Genomics)

		CO-1	CO-2	CO-3
PO-1	Knowledge, understanding	✓		✓
PO-2	Critical Thinking		✓	
PO-3	Problem Solving		✓	
PO-4	Analytical Reasoning			✓
PO-5	Academic Knowledge		✓	
PO-6	Research Skill			✓
PO-7	Business Skill			
PO-8	Human Welfare			✓
PO-9	Ethics Awareness			✓

M.Sc. (ZOOLOGY)		**IVTH SEMESTER**	
COURSE CODE:		**COURSE TYPE: ECC/CB**	
COURSE TITLE: Genomics, Metagenomics and Epigenetics- Genomics			
CREDIT:6		**HOURS:90**	
THEORY: 6	**PRACTICAL:0**	**THEORY:90**	**PRACTICAL:0**
THEORY:100(30+70)		**PRACTICAL:0**	
OBJECTIVE: The purpose of the course is to make the students to understand Genomics, Metagenomics and Epigenetics- Genomics			
15 Hours	Organization and structure of genomes - size, complexity, gene-complexity, virus and bacterial genomes, organelle genome, architecture of mitochondrial genome, conserved chloroplast DNA;		
15 Hours	organization and nature of nuclear DNA in eukaryotes; transposable elements, retro-teaspoons, SINE, LINE, Alu and other repeat elements, pseudogenes, segmental duplications.		
20 Hours	Mapping genomes - physical maps, EST, SNPs as physical markers, radiation hybrids, FISH, optical mapping, gene maps, integration of physical and genetic maps; sequencing genomes: high-throughput sequencing, strategies of sequencing, recognition of coding and non-coding regions and annotation of genes, quality of genome-sequence data, base calling and sequence accuracy.		
20 Hours	Bioinformatics - datasets, sequence analysis based on alignment, de novo identification of genes, *in silico* methods. Comparative genomics - orthologs and paralogs, protein evolution by exon shuffling; human genome project, comparative genomics of bacteria, organelles, and eukaryotes		
20 Hours	Large scale mutagenesis and interference - genome wide gene targeting; systematic approach, random mutagenesis, insertional mutagenesis, libraries of knock-down phenocopies created by RNA interference; transcriptome analysis, DNA micro-array profiling, data processing and presentation, expression profiling, proteomics - expression analysis, protein structure analysis, protein-protein interaction.		
SUGGESTED READINGS	1.Principle of Genome Analysis and Genomics, Primrose, S. B. and Twyman R. M., (7th Ed., 2006), Blackwell Publishing Company, Malden, USA 2. Genomes 3, Brown, T. A., Garland Science Publishing, London, UK 3. Bioinformatics: Sequence and Genome Analysis, Mount, D. W., Cold Spring Harbor Laboratory Press, New York, USA		

M.Sc. ZOOLOGY IV SEMESTER -PAPER-V

Course ZOO ECC: Metagenomics- Epigenetics and Chromatin Biology

CO -1 It is expected that the students after completing this course would acquire the theoretical knowledge of genetics.

CO -2 Practical comprehensions for designing the research problems at higher level.

CO- 3 They also would understand the connect the metabolic reprogramming and development of diseases through the lens of epigenetics.

CO -4 Genomics which attempts to give answers to the questions why public health, contributing to disease ,diagnosis, prevention, and treatment and informing reproductive decisions.

Mapping of Programme and Course outcome

(Metagenomics- Epigenetics and Chromatin Biology)

		CO-1	CO-2	CO-3	CO-4
PO-1	Knowledge, understanding	✓			
PO-2	Critical Thinking		✓	✓	
PO-3	Problem Solving				✓
PO-4	Analytical Reasoning			✓	
PO-5	Academic Knowledge				✓
PO-6	Research Skill		✓		✓
PO-7	Business Skill				
PO-8	Human Welfare				✓
PO-9	Ethics Awareness				✓

M.Sc (ZOOLOGY)		IVTH SEMESTER	
COURSE CODE		COURSE TYPE: ECC/CB	
COURSE TITLE: Metagenomics- Epigenetics and Chromatin Biology			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY: 90	PRACTICAL:0
MARKS:			
THEORY: 100(30+70)		PRACTICAL:0	

OBJECTIVE: The purpose of the course is to make the students to understand Genomics, Metagenomics and chromatin biology

20 Hours	Chromatin structure - basic organization of a eukaryotic genome; histone - structure and function; nucleosome as the fundamental particle; 30 nm chromatin fibers, higher order structure of chromatin, chromatin-territories; intra-nuclear spatial organization of chromatin: MARs and SARs and their importance
20 Hours	Epigenetics - from phenomenon to field, a brief history of epigenetics - overview and concepts; chromatin modifications and their mechanism of action, concept of 'histone-code' hypothesis, epigenetics in *saccharomyces cerevisiae,* position effect variegation, heterochromatin formation, and gene silencing in *Drosophila*
- 20Hours	fungal models for epigenetic research: *Schizosaccharomyces pombe* and *Neurospora crassa*; epigenetics of ciliates; RNAi and heterochromatin assembly, role of noncoding RNAs; epigenetic regulation in plants.
15 Hours	Chromatin structure and epigenetics marks - transcriptional silencing by polycomb group proteins , transcriptional regulation by trithorax group proteins, histone variants and epigenetics , epigenetic regulation of chromosome inheritance, epigenetic regulation of the X chromosomes in *C.elegans*, dosage compensation in *Drosophila*, dosage compensation in mammals; types mechanism of chromatin remodeling.
15 Hours	Epigenetics and genome imprinting - DNA methylation in mammals, genomic imprinting in mammals, germ line and pluripotent stem cells , epigenetic control of lymphopoiesis , nuclear transplantation and the reprogramming of the genome. epigenetics and human disease, epigenetic determinants of cancer.
SUGGESTED READINGS	1. *Epigenetics*, C. David Allis and Thomas Jenuwein, (2007)Cold Spring Harbor Laboratory Press, New York, USA 2. *Molecular Biology of Gene*, Watson et al., (5th Ed. 2004), Pearson Education, Delhi, INDIA

M.Sc. ZOOLOGY SEMESTER IV PAPER V

Course ZOO ECC: Biomolecules and Metabolic Regulation

CO -1 It is expected that a student after taking up this course would acquire the knowledge and understanding of evolutionary design of each metabolic pathways and its intermediates.

CO -2 The student would be able to predict the futuristic outcome of failure of metabolic pathways Consequently.

CO- 3 A scheme of intervention for metabolic failure through life style management can be predicted and which may also result into design of drugs.

Mapping of Programme and Course outcome

(Biomolecules and Metabolic Regulation)

		CO-1	CO-2	CO-3
PO-1	Knowledge, understanding	✓		
PO-2	Critical Thinking	✓	✓	
PO-3	Problem Solving			
PO-4	Analytical Reasoning	✓		✓
PO-5	Academic Knowledge			
PO-6	Research Skill		✓	
PO-7	Business Skill			
PO-8	Human Welfare			✓
PO-9	Ethics Awareness			

M.Sc. (ZOOLOGY)		IVTH SEMESTER	
COURSE CODE: ZOO -45		COURSE TYPE: ECC/CB	
COURSE TITLE: Bio molecules and Metabolic regulation			
CREDIT:6		HOURS:90	
THEORY: 6	PRACTICAL:0	THEORY: 90	PRACTICAL:0
MARKS:			
THEORY: 100(30+70)		PRACTICAL:0	
OBJECTIVE: The purpose of the course is to make the students to understand bio molecule and metabolic regulation.			

20 Hours	Biochemical composition of living organism- 1 Saccharine general properties and structure of Monosaccharides (glucose and fructose) 2 Disaccharides (Lactose and sucrose).3 Polysaccharides (Starch , glycogen , Cellulose).
20 Hours	1 Amino acids- occurrence ,structure , biological importance and general chemistry .2 Primary bond ,peptide bond involve in protein structure .3 Secondary bond Disulfide Hydrogen ,Non polar or hydrophobic and ionic bond .4 Protein configuration-a. Primary structure. B. secondary structure. C. Tertiary and Quaternary structure.
20Hours	1 General structure of Lipids .2 Classification and properties of Lipids .2 primary and secondary structure of Nucleic acid .3 Classification and nomenclature of Enzymes .4 Regulation of Enzyme activity .5 Coenzyme.
15 Hours	Hormonal regulation and its Metabolic activity -1 Carbohydrate metabolism .2 Protein metabolism.3 Fat metabolism .4 Calcium homeostasis .5 Biochemical Energetic.
15 Hours	1 Immobilize enzyme and their application. 2 Classification of Protein. Biophysics-3 PH and buffer.4 Acidity and Alkalinity. 5 Colloids .6 Hydrogen ion concentration.
SUGGESTED READINGS	1 Molecular biology Dr P S Verma. 2 Cell Biology –Carp. 3 Cell biology Albert .

M.Sc. ZOOLOGY SEMESTER IV Paper-V

Course ZOO ECC: Population Genetics, Evolution and Genetics Variability

After successful completion of the course the student will be able to:-

CO- 1 Understand the uses and limitations of phylogenetic trees.

CO- 2 Students will gain knowledge about the relationship of the evolution of various species and the environment they live in.

CO -3 They will be motivated to work towards mitigating climate change so that well adapted species do not face extinction as a result of sudden drastic changes in environment.

CO- 4 The knowledge gained from study of variations, genetic drift can be applied to ensure that conservation efforts for small threatened populations are focused in right direction.

CO -5 The course would allow the students to predict the practical implication of various evolutionary forces acting on the human population in the field of human health, agriculture and wildlife conservation.

CO- 6 Use of various software can generate an interest in the mind of learners towards the field of bioinformatics and coding used in programming language.

Mapping of Programme and Course outcome

(Population Genetics, Evolution and Genetics Variability)

		CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1	Knowledge, understanding	✓					
PO-2	Critical Thinking		✓		✓	✓	✓
PO-3	Problem Solving						
PO-4	Analytical Reasoning		✓	✓			
PO-5	Academic Knowledge				✓		
PO-6	Research Skill						
PO-7	Business Skill						
PO-8	Human Welfare					✓	
PO-9	Ethics Awareness						

M.Sc. (ZOOLOGY)		IVTH SEMESTER	
COURSE CODE:		**COURSE TYPE: ECC/CB**	
COURSE :-Population Genetics, Evolution and Genetics Variability.			
CREDIT:6		**HOURS:90**	
THEORY: 6	**PRACTICAL:0**	**THEORY: 90**	**PRACTICAL:0**
MARKS:			
THEORY: 100(30+70)		**PRACTICAL:0**	
OBJECTIVE: The purpose of the course is to make the students to understand Embrology.			
20 Hours	NEO-DARWINISM :-Hardy- Weinberg law of genetic equibrium. A detailed account of destabilizing forces 1-Natural selection 2-Mutation 3-Genetic drift 4-Meiotic drive, Genetic of speciation. Phylogenetic and biological concept of species.		
20 Hours	Molecular evolution-Gene evolution, Assessment of molecular variation Origin of higher Categories Major trends in their Origin of major categories micro macro and mega evolution.		
20Hours	Molecular phylogenetic-How to construct phylogenetic tree? Amino acid Sequence and Phylogeny. Phenotypic variation .Phenotypic plasticity. .		
15 Hours	Genetic Variability-Genetic Structure of natural PopulationsModels explaining changes in genetic structure of population genetic.Patterns of change in nucleotide and amino acid sequences .Ecological significance of molecular variations. Emergence of neo-Darwinism-Natural Hypothesis. Genetic of Quantitative traits in population .Quantitative traits and natural selection.		
15 Hours	Genotype environment interaction .Inbreeding depression and heterosis .Population genetic and Ecology-Meta populations .Why small population become extinct? Conservation of genetic resources in diverse taxa.		

Fourth Semester
Practical/Lab Work-I
Animal Behavior and Parasitism

-To study the Geotaxis behavior of Earthworms.
-To study the Orientation responses of 1st instars nuclide larvae to photo stimuli.
-Identification of different store grain and vegetable pests.
-To study the Median Threshold concentration of sucrose solution in eliciting feeding responses of Housefly.
-Study of prepared Slide and Specimens of selected Parasites of representative groups of protozoans, helminthies and Arthopods.
-Demonstration of in-Vitrocluture of Plasmodium (Slide of Plasmodium)
-Slide of Protozoa.
-Culturing Insect Parasite Nematode and chasing the lifecycle of the Nematode on the Insect Host.
-Study the Infection of Nematode Plant by Root knot Nematode.

Practical II
Cell Biology and Endocrine Physiology, Genomics

Specimen of vertebrate,
Slide of Vertebrate,
different types of Palates. Bone of Fish, Amphibia, Reptilia, Aves, Mammalia.
Study of different types of microscope (Fluresescence microscopy, Autoradiography, Ultramicrotome, Scanning Electron microscope (SEM)
Histological study of different tissue in Vertebrates.
Squash preparation. Chironomous Salivary gland.
Dissection of Grasshopper testis.
-Study of charts and models Pertaining to Biotechnology and cloning etc.