SOLAPUR UNIVERSITY, SOLAPUR

M. Sc. –II- ZOOLOGY

SYLLABUS

(CHOICE BASED CREDIT SYSTEM)

(w.e.f. 2016-17)

The syllabus of M.Sc. – Zoology course of two years duration has been prepared as per the Choice based credit system (C.B.C.S.). M. Sc. II syllabus is to be implemented from June 2016. The syllabus of M. Sc. Part I was implemented with effect from June 2015. The syllabus has been prepared taking into consideration the UGC guidelines, SET, NET examination syllabus, the syllabus of other universities and the specific inputs of the Expert Committee Members.

General Structure of the Course: The course will be of four semesters spread over two academic years. Each semester will have four theory papers of 70 marks each for University External Examination and 30 marks each for Internal Examination and two practical courses of 70 marks each for University External Examination and 30 marks each for Internal practical course. The distribution of marks is as mentioned below. Theory Paper (Semester Exam), 16 X (70+30) marks 1600 marks

Practical's (Semester End Exam.), 8 X (70+30) marks 800 marks

Seminars for each Semester, 4 X (25 Marks) 100 marks

Total: 2500 marks

SEMESTER-I

Theory Paper No.	Title of Theory Paper	Marks			Credits
		UA	CA	Total	
I	Biosystematics	70	30	100	4
II	Tools and techniques in Biology	70	30	100	4
III	Cell and Molecular Biology	70	30	100	4
IV	Population Genetics and Evolution	70	30	100	4
Practical Course No.	**Title of Practical Course**	**Marks**			**Credits**
		UA	**CA**	**Total**	
I	Practical based on paper I&II	70	30	100	4
II	Practical based on paper III&IV	70	30	100	4
	Seminar – I	--	25	25	1
				625	**25**

SEMESTER-II

Theory Paper No.	Title of Theory Paper	Marks			Credits
		UA	CA	Total	
V	Computational Biology	70	30	100	4
VI	General and Comparative Endocrinology	70	30	100	4
VII	Development Biology	70	30	100	4
VIII	Environmental Physiology	70	30	100	4
Practical Course No.	**Title of Practical Course**	**Marks**			**Credits**
		UA	**CA**	**Total**	
III	Practical based on paper V&VI	70	30	100	4
IV	Practical based on paper VII&VIII	70	30	100	4
	Seminar – II	--	25	25	1
				625	**25**

Practical Course: (Semester End Examination) Practical Paper - I to IV for semester I and II. Practical Examination 2days for each semester

SEMESTER-III

Theory Paper No.	TITLE OF THEORY PAPER	Marks			Credits
		UA	CA	Total	
IX	**Molecular Cytogenetics**	70	30	100	4
X	**Biochemistry**	70	30	100	4
XI	**Comparative Animal Physiology**	70	30	100	4
XII* **ELECTIVE**	**A) Wild life and Conservation Biology OR B) Research Methodology and IPR in Zoology**	70	30	100	4
Practical Course No.	**TITLE OF PRACTICAL COURSE**	**Marks**			**Credits**
		UA	**CA**	**Total**	
V	**Practical based on Paper IX and X**	70	30	100	4
VI * **ELECTIVE**	**Practical based on Paper XI and XII (In XII practical A or B as Elective)**	70	30	100	4
	Seminar – III	--	25	25	1
				625	**25**

*Theory Paper - XII is offered as an elective under CBCS to the students.

SEMESTER-IV

Theory Paper No.	TITLE OF THEORY PAPER	Marks			Credits
		UA	CA	Total	
XIII	**Animal Biotechnology**	70	30	100	4
XIV	**Applied Zoology**	70	30	100	4
XV	**Environmental Biology and Toxicology**	70	30	100	4
XVI* **ELECTIVE**	**A .Zoo keeping and Animal House Management Or B.Helminthology**	70	30	100	4
Practical Course No.	**TITLE OF PRACTICAL COURSE**	**Marks**			**Credits**
		UA	**CA**	**Total**	
VII	**Practical based on Paper XIII and XIV**	70	30	100	4
VIII **ELECTIVE**	Practical based on paper XV & XVI (In XVI practical A or B as Elective) Paper XV and XVI 50% marks for Practical and 50% for Certified **Project Report**	70	30	100	4
	Seminar	--	25	25	1
				625	**25**

*Theory Paper –XVI is offered as an elective under CBCS to the students.

*Practical Paper – VI and VIII are offered as elective under CBCS to the students

Practical Course (SEM-III): (Semester End Examination) Practical Papers – V to VI for semester III Practical Examination will be of 2 days (per day per subject).
Practical Course (SEM-IV): (Semester End Examination) Practical Papers – VII toVIII will be of 2 days,

SUMMARY

Course	No. of Papers	Total marks	Examination Pattern		Total Credits
			UA	CA	
Core	14	1400	980	420	56
Elective	04 (any two)	200	140	60	08
Practical Course	08	800	560	240	32
Seminars	04	100	-	100	04
TOTAL		**2500**	**1680**	**820**	**100**

Nature of Examination: Each semester will have theory University external examination of four papers of 70 marks each (2 and 1/2 hrs. duration). The practical examination of Semesters I to IV will be conducted at the end of the each Semester. Duly certified copy of laboratory record must be produced at the time of examination.

Practical Examination of M. Sc. II The practical examination will be of 2 days for each semester. There will be 70 marks University external practical examination while 30 marks internal examination. The distribution of marks for each Practical paper -V, VI, VII and VIII will be of 70 marks each. Project work and its report of 50 marks will be included in Practical paper – VIII(B) whereas distribution of marks for Practical paper –VIII(B) will be as below:
The report shall be examined by the Examiners (appointed by the University) who will assign marks out of 35 for project work as follows:

1) Selection of the project topic - 2 marks
2) Literature review - 2 marks
3) Objectives - 2 marks
4) Experimental Design - 5 marks
5) Result and Discussion - 2 marks
6) Conclusion and findings - 2 marks
7) Report Writing - 10 marks
8) Oral presentation and Viva - 10 marks

Total: 35 marks

** The valuation to be done by both external and internal examiners at the time of Practical paper V to VIII practical examination. Valuation of Seminars is to be done by Departmental Faculty involved in Zoology.

Nature of Theory question paper for each theory paper.

SOLAPUR UNIVERSITY, SOLAPUR
Nature of Question Paper for Semester Pattern
(New CBCS)
M.Sc. Zoology

Time:- 3 hrs **Total Marks-70**

Note: 1) Q 1, 2 & 6 are Compulsory

2) Answer any two questions from Q3, 4 & 5

Q. 1 A) Multiple choice questions **(per question 2 marks)** **(14)**

i) ----------

a) b) c) d)

ii)

iii)

iv)

v)

vi)

vii)

Q. 2) Long answer type question(**Compulsory**) **(14)**

Q. 3) Answer the following

A) **(7)**

B) **(7)**

Q. 4) Explain the following

(A) **(5)**

(B) **(5)**

(C) **(4)**

Q. 5) Explain in short

(A) **(7)**

(B) **(7)**

Q. 6) Write Short notes on any *TWO* of the following **(14)**

i) Short note

ii) Short note

iii) Short note

N.B. In Q.5 and 6 the sub-questions (i, ii, and iii) in a given question should be from different topics of the syllabus.

At least 25 % questions should be problem oriented, where-ever possible, in view to train students for the SET/NET/GATE and other competitive examinations. These questions should test the understanding of candidate rather than the memory. The question paper should cover all the Units included in the syllabus of the respective paper and the weightage of the questions should correspond to the number of lectures allotted to the respective Units / Topics.

M. Sc. ZOOLOGY SYLLABUS

SEMESTER- III

Paper-IX: Molecular cytogenetics [Teaching periods-45] No. of credits=4

Unit No. I (A) Fine Structure of Gene: Prokaryotic and Eukaryotic genome organization, Metaphase chromosome. Structure of chromatin, centromere, Telomere and its maintenance.Heterochromatin and euchromatin. Coding and noncoding sequences, Satellite DNA,Amplification and rearrangement. **(B)** Dosage compensation of sex determination in *Caenorhabditis elegans, Drosophila* and human **(C)** Imprinting of genes , chromosomes and genomes. (10)

Unit No. II Genome analysis:
C value paradox, detailed account of various models of prokaryotic genomes, viral genomes, Eukaryotic genomes,organization of genes in organelle genomes. Molecular analysis of genomic DNA in yeast.Transposable elements in genetic regulation. Genome analysis – humans Yeast, microbial genomes. (10)

Unit No. III Microbial genetics :
Bacterial chromosomes, Bacteriophages- types, structure and morphology of T4 phage.Morphogenesis, Lysogeny and Lytic cycle in Bacteriophages, Host cell restriction, Complementation, molecularrecombination, DNA ligases, topoisomerases, Gyrases,Methylases, Nucleases, restriction endonucleases, Plasmids and bacteriophage based vectors for cDNA and genomic libraries. (10)

Unit No. IV Human cytogenetics:
Techniques in human chromosome analysis. Molecular cytogenetic Approach. Human karyotype, banding, nomenclature.Chromosome based heritable diseases in human. For exampleSickle Cell Anemia, PKU, thalassemia and glaucoma (05)

Unit No.V(A) Cytogenetic implications and consequence of structural and numerical alterations of chromosome. Cytogenetic effects of ionizing and non-ionizing radiation. **(B)** Genetics of cell cycle: Genetic regulation of cell division in yeast and eukaryotes. Molecular basis of cellular check points. **(C)** Molecular cytogenetic techniques Automated karyotyping Chromosome painting, DNA Sequencing. Application of RFLP in forensic Science, disease prognosis, genetic counselling and pedigree analysis. (10)

Books Recommended
1. Molecular Biology of the Gene, J.D. Watson , N.H. Hopkins, J.W. Roberts et al The Benjamin/Cummings Pub. Co. Inc., California
2. Molecular Cell Biology, J. Darnell, H Lodish and D. Baltimore Scientific American Books, Inc, USA.
3. Molecular Biology of the Cell B. Alberts, D. Bray. J. Lewis < J.D. Watson. Garland Publishing Inc. New York
4. Molecular Biology and Biotechnology. A comprehensive desk reference. R.A. Meyers (Ed) VCH Publishers, Inc New York
5. Genes VI/VII Benjamin Lewin Oxford University Press UK

6. Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Ltd., New York
7. Cell Physiology Molecular Dynamics, Henry Tedeschi (2003) .Running Text Book available on Web link only
8. Essentials of Human Genetics (1990) Orient Longmans Ltd. Bombay

Paper X Biochemistry [Teaching periods-45] No. of credits=4

Unit No. I Structure and role of carbohydrates, lipids, proteins, nucleic acids (A-, B-, Z-, DNA, tRNA), Micro RNA (10)

Unit No. II Oxidative phosphorylation, energy conservation and release. cyclic AMP-its structure and role. Bioenergetics, biological energy transducers, Concept of free energy, Redox potential Thermodynamic principles of biology. Hydrogen bonding, energy rich bonds. (10)

Unit No. III Glycolysis, TCA cycle, glycogen breakdown and synthesis, inter conversion of hexoses and pentoses. Amino acid metabolism. coordinated control of metabolism Biosynthesis of purines and pyrimidines. (10)

Unit No. IV Biosynthesis of fatty acids, triglycerides, phospholipids and steroids. β- Oxidation of lipids. Metabolic regulation during hypoxia. (05)

Unit No. V(A) Classification and nomenclature of enzymes. Co-enzymes, isoenzymes, allosteric enzymes, ribozyme, abenzymes , enzyme activators, inhibitors, Mechanism of enzyme Catalysis. **(B)** Enzyme kinetics: Michaelis – Menten equation. Regulation of enzyme activity by non genetic mechanisms. Negative and positive co-operativity. **(C)** Metabolic engineering, site directed mutagenesis and enzyme engineering. **(D)** Immobilised enzymes and their applications. (10)

Reference Books

1. Biochemistry of Plants and Animals Mallette M.E.
2. Cell Physiology and Biochemistry Mcelroy W.D.
3. Biochemistry, D. Voet and J.G. Voet , J. Wiley and Sons (Now Pearson Education)
4. Biochemistry Mathews C.K. , Holde K.E. Pearson Education
5. Nature of Enzymology R.L. Foster
6. Enzyme Biotechnology Tripathi G.
7. Basic Separation Techniques in Biochemistry (1998) Okotore R.O. New Age Internationals New Delhi.
8. Fundamental Lab Techniques in Biochemistry and Biotechnology (1998) Ninfa A.J. and Ballou O.P. Fitzgeralf Science Press Bethesba
9. Leningers principles of Biochemistry Nelson and Cocks (2001) Mac Millan and Co.
10.Modern Experimental Biochemistry Boyer and Rodney (2001) Benjamin Cunnings NY.
11.Biochemistry Methods Vote D. and Vote J.G. John Wiley USA (2004)

Paper XI Comparative Animal Physiology [Teaching periods-45] No. of credits=4

Unit No. I Feeding mechanism and its regulation. Food and diet specificity. Comparative physiology of digestion and nutrition. (10)

Unit No. II(A) Physiology of respiratory pigments in different phylogenetic groups. Circulation of body fluids and its regulation. pH regulation of body fluids. **(B)** Patterns of nitrogen excretion among different animal groups. Osmoregulation in freshwater and marine fishes. Desert adaptations of osmoregulation. **(C)** Thermoregulation in Poikilotherms, Homeotherms . Hibernation **(D)**Communication in Bees. (10)

Unit No. III (A) Chromatophores and its regulation. Role of chromatophores. **(B)** Physiology of light reception and visual perception. (05)

Unit No. IV(A) Physiology of contractile elements – actin, actomyosin, myofilaments, microtubules, myosin, voluntary and involuntary muscles, Cardiac muscle physiology. Role of isoenzymes (LDH) in cardiac physiology. **(B)** Physiology of sleep and anaesthesia. **(C)** Control of reproductive mechanism in amniotes(reptiles, birds and mammals) and their Reproductive cycles. (10)

Unit No. V(A) Physiology of nervous system with reference to neurohormone regulation in mammals. **(B)** Neurotransmitters: Major sense organs and receptors, Homeostatis(Neural and hormonal), Bioluminiscence, Circiadian rhythms (10)

Reference Books

1. Comparative Animal Physiology. C.L. Prosser. W.B. Sounders and Company
2. General and comparative physiology W.S. Hoar,
3. Animal Physiology: Adaptations and Environment. Schmidt- Nielsen Cambridge
4. Chemical Zoology Academic Press Edited by Florkin and Sheer 7 Volume series
5. Physiology of Mammals and other vertebrates Marshall and Hughes
6. Chemical Zoology Ed. Florkin and Sheer B.T. Academic Press Vol. 1-10.
7. Text Book of Medical Physiology: Guyton , Prism Publishers Bangalore 2004 Ed
8. Comparative Physiology : B.T. Sheer

OPEN ELECTIVE

Paper-XII: (A) Wild life and Conservation Biology [Teaching periods-45] No. of credits=4

Unit No. I (A) Ecosystem and community : Definition and characteristics of community, classification of communities, composition of community, structure/stratification of community, community metabolism and stability, habitat and Niche. **(B) Ecological succession:** Ecotypes, ecotone, age effect and ecological indicators. (10)

Unit No. II Factors affecting ecosystem and community structure:
a. Natural factors: Earthquakes, Tsunamis, volcanoes, landslides and cyclones.
b.Intracommunity factor- competition, antagonism, predation and disease
c. Anthropogenic factors: Introduction of exotic species, urbanization, industrialization, sports and tourism. Habitat loss and its effect on wild life. Patch formation, discontinuous distribution. Breaking of food chain (10)

Unit No. III(A) Quantitifying community diversity: Indices of diversity, species rare fraction curves, estimating the total number of species, species areacurve, species abundance distributions **(B)** Conservation of nature and natural resources: **(C)** Traditional conservation practices, agricultural practices, fishing methods etc. (10)

Unit No. IV. Modern conservation practices, Reserve forests, sanctuaries, national parks, biosphere reserves, Biodiversity hotspots etc. Captive breeding of endangered species (10)

Unit No. V. Indian Forest Acts, Indian wild life act, red data book and TRAFIC, Earth Summit and agenda, environment impact assessment (EIA) (05)

Reference Books

1. Ecological Methods with particular reference to the study of insect Populations; Sothwood T.R.E.
2. The Oxford Anthology of Indian Wild life Vol I Hunting and Shooting
3. The Oxford Anthology of Indian Wild life Vol II Watching and Conserving
4. Nair S.M. Endangered Animals in India and Their Conservation
5. English M.A. Animal Kingdoms : Wild Sanctuaries of the World
6. Sanctuary Asia : Bimonthly Journal
7. Biodiversity: E.O. Wilson (1988) National Academies Press

Paper – XII (B): Research Methodology and Intellectual Property rights

[Teaching periods-45] No. of credits=4

Unit I

Collection of literature- Books - Journals. Digital library and search of articles - Key words and search - Internet – Google Scholar – Pub med – Inflibnet – Medline – Agricola – Science direct - Open access Journals - other sources. Short communications –review articles. Funding agencies UGC, DBT, DST. (10)

Unit II

Collection of samples / data – Data analysis – Microsoft Excel – Construction of tables – headings - footer - hypothesis testing – Test of Significance – Tabulation – Presentation of results - Use of SPSS. (10)

Unit III

Publishing of Articles in National and International Journals - Selection of Journals – ISSN Number – Peer reviewed Journals – Science citation index – impact factor and its importance. Manuscripts preparation for Journals – components – Submission and Publication – reprints and pdf formats. Paper presentation in Conferences. (10)

Unit IV

Thesis structure –Components - Writing Introduction – review of literature – Materials & Methods – Presentation of results – Discussion of Results based on literature – Arriving conclusions – Briefing of Summary – Arrangement and how to quote reference in thesis - Appendix. (05)

Unit V

Intellectual property rights -Introduction- Protection of intellectual property, copyright, trademark, geographical indications, trade secrets, Layout design of integrated circuits. Patent-Criteria and procedure of patenting, patenting biological material.Patent procedure inIndia.Revocation of Turmeric and Neem patent.Patenting of biological material with example and case studies. (10)

Reference Books

1. Anderson, Durston&Polle 1970: Thesis and assignment, writing Wiley Eastern Limited
2. G. Vijayalakshmi and C. Sivapragasam. (2008) Research Methods –Tip & Techniques, MJP Publishers, Chennai. WWW.mjppublishers.com
3. Malter K, 1972: Statistical analysis in Biology, Chapmen Hall, London.
4. Kothari C. R., Research Methodology: Methods & Techniques. New Age Publ., New Delhi, 2012

Practical: (V) (Practical based on paper IX&X)

1. Human karyotype analysis from photographs, Types of chromosomes,
2. FISH technique
3. Barr body identification and staining
4. Examples of Mendelian inheritance of human genetical diseases
5. Pedigree analysis of human population.
6. Estimation of blood urea.
7. Colorimetric estimation of glucose.
8. Colorimetric estimation of Protein.
9. Isozyme LDH separation by Electrophoresis.
10. Estimation of fat / water soluble vitamins
11. Colorimetric estimation of Lactose in Milk.
12. Preparation of Casein.
13. Electrophoresis of proteins.
14. Excursion Tour.

Practical (VI- Practical based on paper XI)

1. Study the oxygen consumption of aquatic animals under stress.
2. Respiratory pigments their analysis and oxygen carrying capacity.
3. Ammonia estimation in body fluids (suitable invertebrate –crab/earthworm)
4. Demonstration of Blood gas analysis.
5.Peritoneal and membrane dialysis. (Experiment may be designed with egg membrane).
6.Comparison of RBCs and WBCs in different groups of vertebrates under different environmental conditions.
7. Enzyme separation by $MgCl_2$ gradient methods.
8.Any other practical set by Department

Practical (VI- Practical based on paper XII)

Elective A:

1. Community sampling, quadrat sampling for plants- relative abundance distribution,
2. Community sampling for animals- relative abundance distribution
3. Plaster cast methods for pug mark identification
4. Identification and survey methods of wild life.
5. Hair, antlers, teeth, skin, hide, skull, bones, ivory identification of wild life.
6. Case studies of habitat loss and wild life protection act. Data collection in practical hand book expected.
7. Any other practical set by Department.

Elective B: Research Methodology and IPR in Zoology

1. Preparation of project proposal for Funding agencies (UGC)
2. To suggest a title to the given abstract/paper.
3. Assigning legends to given graphs, figures and captions to given tables.
4. Study of proof correction symbols; proof- reading the given text and correcting the proofs.
5. Designing of tables and graphs from the given data.
6. How to write materials and methods, observation section of a research paper .

7. Write discussion section for the given discussion less research paper.
8. Citations/ References: how to find and cite references from journals, books and databases`.
9. Oral presentation: Rhythm, style, control, mock presentation for 10 minutes
10. Procedure for copyright, trademark.
11. Writing of Indian patent.

Paper XIII Animal Biotechnology [Teaching periods-45] No. of credits=4

Unit No. I(A) Cell and tissue culture. Primary cultures, cell line, cell clones, somaclonal variations, micropropagation , somatic embryogenesis Haploidy, protoplast fusion, and somatic hybridization, Cybrids, Gene transfer methods. Transgenic biology, Allelopathy (10)

Unit No. II Principles and techniques of nucleic acid hybridization and cot curves. Sequencing of proteins and nucleic acids. Computerized models to study Southern, Northern and Western blotting techniques. Polymerase chain reaction . Methods for measuring nucleic acid and protein interactions. FISH and GISH (10)

Unit No. III Regulation of gene expression in pro and eukaryotes. Attenuations and operon concept. DNA methylation, Heterochromatization, transposition, regulatory sequences, transecting factors, Environmental regulation of gene expression. (10)

Unit No. IV(A) Organization of transcriptional units: Mechanism of transcription of prokaryotic and eukaryotic cells. RNA processing (Capping, polyadenyalation, splicing, introns andexons). Ribonucleoprotiens. Structure of mRNA, genetic code and protein synthesis. **(B)** Cell diversification in early embryo, stem cell and stem cell therapy. Totipotency and pleuripotency, embryonic stem cells,renewal of stem cells- epidermis, hemopoitic stem cells, stemcells disorder, blood cell formation, bone marrow transplant/ placental(cord) blood protocol. (10)

Unit No.V(A) Principles and methods of genetic engineering and gene targeting, application in agriculture, health, medicine and industry. **(B)** Ethical issues in human cloning and biotechnology. Biosafety regulations (05)

Reference Books

1. Guidelines for Human Embryonic Stem Cell Research National Academies Press (2005)
2. Stem Cells and Future Regenerative Medicine (2002) National Academies Press
3. Animal Cell Culture A Practical Approach Ed, John R.W. Masters IRL Press
4. Cell Culture Handbook “Sigma”. (Available with the help of Internet Search Sigma Website)
5. Concepts of Genetics Klug W.S. Cummings M.R. (2005) Pearson Education , Delhi
6. Campbell A.M. and Heyer L.J. Discovering Genomics, Proteomics and Bioinformatics Pearson Education (2004)
7. Selvin J. and Others : Biotechnology Emerging trends, Biotech Books Delhi (2003)
8. Cellular Interaction and Immunology (1994) Open University Netherlands University of Greenwich, UK.

Paper XIV Applied Zoology [Teaching periods-45] No. of credits=4

Unit No. I Reproductive technology- Collection andcryopreservation of gametes. Semen analysis, Ovulationinduction, Fertility control, amniocentesis, IVF sterility and its treatment. Gamete intrafallopian transfer, Surrogate pregnancyand gestational carrier. Fertility control in male and female.Modern trends in contraception. Hormonal assay. Cancer and reproductive tract infections. (10)

Unit No. II(A) Immunology-History, Overview, and scope. **(B)**Antigen antigenicity , cells and tissue immune system. Innateimmunity, Humoral immunity, B lymphocytes,Immunoglobulins, organization and expression of Ig genes. **(C)** Cell mediated immunity, T lymphocytes, Major Histocompatability complex. Class I and II molecules. HLAsystem in human. (10)

Unit No. III Development of polyclonal sera, monoclonal antibody production and characterization, Vaccines againstcommunicable and infectious diseases. Conventional andgenetically engineered vaccines. DNA vaccines, Immunological tolerance. (10)

Unit No. IV(A) Blood bank protocols : Blood matching, separation blood cells,plasma and serum. Blood cell Routine tests of blood for hepatitis and ELISA. **(B)** Biological warfare and its control. Common methods of biological warfare. Resistance mechanism against biological warfare. (10)

Unit No.V(A) Vermitechnology- Importance of vermiculture. Vermiwash, Vermicompost Earthworms as protein source. **(B)** Important human and veterinary parasites (Protozoa and helminthes) Molecular basis of host parasitic interaction. (05)

Reference Books

1. Animal Health at Cross Roads : Preventing Detecting and Diagnosing Animal Diseases (2005)
2. IVF Protocol (Wikipedia) The Free Web Encyclopaedia
3. Biotechnology Research in Age of Terrorism: National Research Council (2004) National Academies Press
4. Earthworms-Their Ecology and Relationship with Soils and Land Use; Lee K.E.
5. Modern Immunology : Dasgupta
6. Biology of Earthworms ;Edwards C.A. and Lofty J.R
7. Vaccines
8. Blood Transfusion Merck manual (Available on Internet)
9. Immunology; Roitt I.M. / Brostoff J.

Paper XV Environmental biology and toxicology [Teaching periods-45] No. of credits=4

Unit No. I(A) Concept and dynamics of ecosystem, components, food chain and energy flow, productivity and biogeochemical cycles, typesof ecosystem. Population ecology and biological control, lotic and lentic. **(B)** Limnology- Ecology of lakes ponds and water dams. Agricultural land ecosystem problems (10).

Unit No. II Kinds of aquatic habitats(freshwater and marine), distribution of and impact of environmental factors on the aquatic biota, productivity, mineral cycle and biodegradation in differentaquatic ecosystems, biology and ecology of reservoirs.Management of green house and poly house. Induced Pisciculture. (10)

Unit No. III(A) Environment pollution in terms of air, water, soil, noise Legislation and Indian standards of pollution levels. Causes andeffects of pollution. Radiation and thermal pollution. (Casestudies : Chernobyl and three mile island. Minamata disease, Methyl Isocyanates poisoning in Bhopal) Remedial measures. **(B)** Case studies of urban trash management. Carbon credits. Solid waste management. Litter and plastic wastemanagement. Biological indicators of pollution **(C)** Industrial pollution their control with reference to textile, sugar and dairy industries. (10)

Unit No. IV Conservation of natural resources. Rain water harvesting system. Water recycling. Waste water management (05)

Unit No. V Toxicology- Classification of toxicants, toxic agents, mode of action. Pesticides, metals, Toxic agents in house hold use. Soil toxicants. Carcinogens used in industries. Food additives in the form of food colours and preservatives. Indian standards. (10)

Reference Books

1. Singh H.R. Introduction to Animal Ecology and Environmental Biology
2. Lee K.E. Earthworms Their Ecology and Relationships with soil and Land use (1985) Academic Press , New York
3. Matsumura Fumio Toxicology of Insecticides (1985) Plenum Press New York
4. Jakob T. Food Adulteration (1977) Macmillan Comp Delhi
5. Jacob T. Foods, Drugs and Cosmetics (1977) Macmillan Comp Delhi
6. Text Book of Environmental Science Purohit/Shammi/ Agrawal (2005 reprint) Student Edition Jodhpur
7. Environmental Biology : Eric Bharucha UGC Press Hyderabad 2005
8. Environmental Toxicology Satake M, Mido Y and others (2001) Discovery Publishers Delhi.
9. Mineral Resources Economic and Environmental Kesler S.E. (1994) Mac-Millan College Publishers London
10.Environmental Medicine Andrew Pope and David Rall (1995) National Academies Press
11.Environmental Challenges in Chemistry in 21st Century Report on Workshop on Environment (2003) National Academies Press
12.Forging a Poison Control System Committee on Poison Control System US (2004)

OPEN ELECTIVE

Paper XVI (A): Zoo keeping and Animal house Management
[Teaching periods-45] No. of credits=4

Unit No. I(A) Introduction, Scope, policy of Zoo keeping. **(B)**Management – Animal behaviour in captivity. Ethical issues - Zoo architecture, Natural habitats, Exhibit design. **(C)**Housing , feeding, breeding, behaviour in crocodile, lizards, snakes and tortoises.Snake identification, venom and antivenin. (10)

Unit No. II Housing, feeding, behaviour, in water and land birds. Enclosure design. Diurnal and nocturnal birds.Management of grain eater and birds of prey. Flightless birds. (10)

Unit No. III(A) Housing , feeding, behaviour in common zoo mammals like monkeys, rabbits, wild cats, ungulates,grazing mammals . Elephant and camel management. **(B)** Veterinary services in zoo. Common disease in zoo reptiles, birds and mammals. Diseases and prevention of zoo diseases. **(C)** Public awareness programmes in a Zoo. Zoo as conservation recreation, research and educational institute. Permanentdisplays in zoo. (10)

Unit No.IV Documentation permissions, visitor rules regulations and surveillance in a zoo. Accidents, fire fighting, first aid to the zoo animals and visitors. (10)

Unit No. V Animal house management- rodent management growth,maintenance, housing, feeding, disinfection procedures inanimal house. Taxidermy and applications. (05)

Reference Books

1. Animal Care and Management at the National Zoo Review Smithsonian Institute's National Zoological Park (2005) National Academies Press
2. An Introduction to Animal Behaviour , (1997)Cambridge . New York
3. Rodents Laboratory Animal Management : National Academies Press1996
4. Animal care and Management at the National Zoo : Smithsonian Institute's National Zoological Park Interim Report (2004)
5. PJC Zoo Animal Technology On line (Free website)
6. Taxidermy .net
7. Animal Health at the cross roads Preventing Detecting and Diagnosing Animal Diseases (2005) National academies Press

PAPER-XVI (B): HELMINTHOLOGY (45Lectures = 4 CREDITS)

Unit I Introduction, history and scope of Helminthology (10)

1. General organization and Classification of Platyhelminthes.
2. General organization and Classification of Nemathelminths
3. Cestodes (Cestodarians and Eucestodes).
4. Trematodes (Monogenea, Aspidobothria and Digenea)
5. Host – parasite Interaction

Unit- II (10)

Geographical distribution, habitat, morphology (Structure), life cycle, pathogenicity, diagnosis, treatment and preventation of the following type.

Trematode:-

1) *Fasciola hepatica*
2) *Fasciolopsisbuski*
3) *Schistosomahaematobium*
4) *Paragonimuswestermani*

Unit- III (10)

Geographical distribution, habitat, morphology (Structure) , life cycle, pathogenicity, diagnosis, treatment and preventation of the following type.

Cestode:-

1) *Taeniasaginata*
2) *Dipylidiumcaninum*
3) *Hymenolepis nana*
4) *Echinococcousgranulosus*

Unit- IV (10)

Geographical distribution, habitat, morphology (Structure) , life cycle, pathogenicity, diagnosis, treatment and preventation of the following type.

Nematode:-

1) *Ascarislumbricoides*
2) *Ancylostomaduodenale*
3) *Wuchereriabancrofti*
4) *Enterobiusvermicularis*

Unit-V: Clinical Helminthology (05)

1) Chemicals and reagents used in preservation of parasitic materials
2) Collection, processing and identification of parasites,
3) Recovery of parasite eggs and larvae from faecal specimens
4) Antihelminthicdrugs

Reference Books

1. Medical Parasitology by Markell, Voge and John, 8thed. W.B. Saunders Co.
2. The Biology of animal parasites, Cheng T.C. (1964)-Saunders International Student Edition.
3. The Invertebrates Vol II, McGraw Hill, New York.- Dawes B. (1946).
4. Text book Medical Parasitology Jaypee Brothers, - Medical Publishers, New York. - Panikar C.K.J (1988)
5. The Parasitology of Trematodes Oliver and Boyd Ltd. Edinburgh - Smyth J.D (1977)

6. Parasitology (Protozoology and Helminthology) -SoodPamnik (1993) CBS Publication and Distrubution, Delhi.
7. Human helmintology Manual for Clinical, Sanitarians Medical Zoologists – Faust, EmerestCaroll.
8. SystemaHelminthum Vol. IV Monogenea and Aspidobothria - Yamaguti S. (1963) Inter- Science Publishers, London.
9. Synopsis of Digenetic Trematodes of Vertebrates - Yamaguti S. (1971) Vol. I & II Keigaku Publishing Co., Tokyo, Japan.
10. Parasitology (Protozoology and Helminthology) -Chatterjee K. D. (1969)
11. The Zoology of Tapeworm. - Wardle and Mcleod (1952)
12. The advances in the Zoology of tapeworm from Wardle and Mcleod (1952)
13. SystemaHelminthum Vol. II Cestoda. - SatyuYamaguti (1959)
14. The Physiology of Cestodes. - J.D Smyth
15. Vertebrate Nematodes - York and Mapelston

Practical (VII- Practical based on paper XIII & XIV)

1. Preparation of cell culture media for animal cell culture
2. Culture methods of microbiology
3. Isolation of pure cultures
4. Media preparation.
5. Microbial analysis of vermicompost.
6. DNA estimation in cells
7. Experiments in induction of fish / frog oocytes.
8. Hormone assay
9. Separation of serum antibodies
10. Estimation of serum antibodies
11. Ovulation protocols
12. One week actual lab work in IVF clinic and in reputed blood bank is expected.

Practical (VIII - Practical based on paper XV & XVI)

1. Water analysis for hardness, detergents, toxicants, colouring agents, nitrates and chlorates.
2. Effect of toxicants on aquatic animals.
3. Record of pollutants of the city.
4. Air sampling methods for dust and fibres
5. Estimation of residual pesticides in water, soil and vegetables.
6. Residual pesticides in fodder and milk.

Elective A: (Zoo keeping and Animal House Management)

1. Design of cattle and poultry food for zoo mammals and birds.
2. Construction of animal house.
3. Common zoo diseases and their remedies. Identification and diagnosis
4. To prepare ethogram of various zoo animals.
5. Any other practical set by the department
6. Visit of grass land /pond for hydrobiological/ food chainstudy in a grass land. Visits of polyhouse, apiculture, sericulture and water reservoir.
7. Any other practical se by the department

Elective B: (Helminthology)

1) Identification of trematodes from various hosts.
2) Identification of cestodes from various hosts.
3) Identification of nematodes from various hosts.
4) Procedure for Preservation, staining and identification of trematodes.
5) Procedure for Preservation, staining and identification of cestodes.
6) Procedure for Preservation, staining and identification of parasitic nematodes.
7) Identification of helminth eggs and larval stages.
8) Study and use of antihelminthic drugs

Project Report : Two hard copies and a power point presentation and a CD of the project is to be submitted during practical examination. A project may be selected at the beginning of the year to get sufficient time for visits data Collection and Presentation.

Equivalence of Syllabus: There is no equivalence for theory and practical of old and new course. The student should appear for theory and practical based on new course only.

Note:

As per the guidelines of **UGC notification number F.14-6/2014(CPP-II) dated 1st August, 2014** it is now essential to make necessary modifications to stop dissection and promote and orient students towards the knowledge component rather than skill development. However, ITC based virtual dissections are promoted. Now, the responsibility to discontinue dissections and use of animals in experiments totally rests on concerned authorities of respective colleges/Institutes. As per the notification it is important to encourage the field trips and observations without disturbing the biodiversity. For laboratory observations existing permanent slides and specimens should be shown. Where ever necessary ,in the practicals charts , models , photographs, CDs ,virtual , simulations ,videos ect.' may be used . As per the guidelines of UGC , all the Zoology departments should be empowered with infrastructure to adopt Information communication technology (ICT) required for the purpose of virtual dissections for which virtual class room / laboratory to be enriched with few computers (according to the strength of students) , internet facility , printer etc.