North Maharashtra University, Jalgaon
SYLLABUS FOR M.Sc. Zoology (Part-I)
(w.e. From June 1997)

SEMESTER-I

ZOO 101	
a) Non-chordate	40 mks
b) Biochemistry	40 mks

	Int. Ass.
	80+20 mks
	Int. Ass.
ZOO 102 Environmental Biology	80+20 mks
ZOO 103	
a) Chordate	40 mks
b) Biostatistics	40 mks

	80+20 mks
	Int. Ass..
ZOO 104 Practical-I	
9 Practicals corresponding to 101 (a)	30 mks
9 Practicals corresponding to 103 (a)	30 mks
7 Practicals corresponding to 103 (b)	20 mks
Internal Assessment	20 mks
ZOO 105 Practical-II	
10 Practicals corresponding to 101 (b)	30 mks
15 Practicals corresponding to 102	50 mks
Internal Assessment	20 mks

SEMESTER-II

ZOO 201	
a) General Physiology	40 mks
b) Writing Scientific reports and oral presentation in English	
OR	
b) Economic Zoology	40 mks
	80+20 mks
	Int.Ass.
ZOO 202 Cellular and Developmental Biology	80 mks
	20 mks
	Int. Ass.
ZOO 203	
a) Molecular Biology & Biotechnology	40 mks
b) Genetics	40 mks

	80+20 mks
	Int.Ass.
ZOO 204 Practical-I	
9 Practicals corresponding to 201 (a)	30 mks
9 Practicals corresponding to 203 (a)	30 mks
7 Practicals corresponding to 203 (b)	20 mks
Internal Assessment	20 mks

ZOO 205 Practical-II	
18 Practicals Corresponding to 202	60 mks
07 Practicals Corresponding to 201 (b)	20 mks
Internal Assessment	20 mks

SEMESTER-III

Paper-1 : Any ONE special paper.

ZOO 301	Reproductive Physiology-I	80+20 mks Int. Ass.
ZOO 302	Physiology-I	
ZOO 303	Entomology-I	
ZOO 304	Fishery Science-I	
ZOO 305	Applied Parasitology	

Paper-2 : Any TWO courses from the following (Zoo 311 to Zoo 314)

ZOO 311	Enzymology	80+20 mks Int. Ass.
ZOO 312	Systematics and Paleontology and Organic Evolution.	
ZOO 313	Parasitology	
ZOO 314	Biophysics.	

Paper-3 :	Any two from the following (Zoo 315 to Zoo 320)	80 mks + 20 mks Int. Ass.
ZOO 315	Emdocrinology	
ZOO 316	Applied Entomology	
ZOO 317	Aquicalture	
ZOO 318	Insect Physiology	
ZOO 319	Computer Programming	
ZOO 320	Taxonomy, distribution and bionomics of fishes.	

ZOO 325 Practical-I	
18 Practicals w.r.t. ZOO 301 to ZOO 305	60 mks
7 Practicals w.r.t. ZOO 311 to ZOO 314 (any ONE course)	20 mks
Internal Assessment	20 mks

ZOO 326 Practical II	
7 Practicals w.r.t. ZOO 311 to ZOO 314 (any ONE course other than ZOO 325)	20 mks
9 Practical w.r.t. each for any TWO course from ZOO 315 to ZOO 320	(30+30) mks
Internal Assessment	20 mks

(Note: Students offering special paper ZOO 305 Applied Parasitology not allowed to take course ZOO 313 Parasitology)

SEMESTER-IV

Paper-1 Any ONE special paper

ZOO 401	Reproductive Physiology-II	80+20 mks. Int.Ass.
ZOO 402	Physiology-II	
ZOO 403	Entomology-II	
ZOO 404	Fishery science-II	
ZOO 405	Applied Parasitology-II	

Paper-4	Any TWO courses from Zoo 411 to Zoo 414	
Zoo 411	Physiology of Reproduction	80 mks.
Zoo 412	Pest Control	Int. Ass.
Zoo 413	Animal behaviour	
Zoo 414	Tnsect Endocrinology	
Paper-3	Any TWO courses from ZOO 415 to ZOO 419	
ZOO 415	Insect toxicology	80+20 mks
		Int.Ass.
ZOO 416	Ichthyology	
ZOO 417	Histochemistry	
ZOO 418	Basic Biotechnology	
ZOO 419	Fish Physiology.	
ZOO 425	Practical-I	
18 Practicals w.r.t. ZOO 401 to ZOO 405		40 mks
7 Practicals w.r.t. ZOO 411 to ZOO 414		15 mks
Project Work / Review		24 mks
Internal Assessment		20 mks
ZOO 426	Practical-II	
9 Practicals each for any two courses from ZOO 415 to ZOO 419		(20 mks+20 mks each)
7 Practicals w.r.t. ZOO 411 to ZOO 414 (any one course other than ZOO 425)		
Project Work/Review		15 mks
Internal Assessment.		25 mks
		20 mks

(Note: A student should begin the Project/Review Work from the beginning of the Semester-III).

ZOO 101 (a) Non chordata

1. Protozoa - Nuclei and Reproduction in protozoa
2. Mesozoa - Structure, general organization and phylogeny
3. Acnidaria - Structure, general organization and interrelationships, origin of Bilateria.
4. Nemertaenia- (Rhynchocephalia) Structure, Organization and interrelationships.
5. Ectoprocta - Branchiopoda, Chaetogna - the, Phoronida. General organization and structure.
6. Arthropoda - Parasitic and sedentary crustacea.
   - Cephalization in Arthropoda
7. Mollusca - Torsion and detorsion
8. Echinodermata - Larval forms - Structure and development.
9. Hemichordata - Affinities and interrelationships.

ZOO 101 (b) Biochemistry

1. Amino acids and proteins : Methods of Isolation and purification.

2. Nucleic acid : Chemistry in brief, Bio-synthesis of purines and pyrimidines, isolation of nucleic acid and characterization.

3. Carbohydrates : Structure of glycogen, Bio-synthesis and degradation, Polarimeter.

4. Lipids : Chemistry in brief, Classification, properties and Beta-oxidation.

5. Biochemical energetics : Concept of free energy, Redox potential, Energy rich Compounds, ATP, ADP, GTP and Co-A. Coupling of endergenic and exergenic reactions with reference to Kerb's cycle and Oxidative phosphorylation.

6. Radioactivity determination : Properties of Alpha, Beta, Gama rays. Radio active isotopes, half-life period, Units of radioactivity, GM-Counter, Scintillation counter, Applications of Radioisotopes and Autoradiography.

7. Techniques and Instrumentation. Analytical Biochemistry - with special reference to Bio-Micromolecules, proteins, enzymes and Nucleic acids.

   Colorimetry : Beer's and Lambert's law, essential Component of colorimeter, Single beam and double beam.

   Spectroscopy : Single, Double beam and UV - spectrometry.

   Centrifugation : Analytical preparation, Density gradient,

   Centrifugaaion, Zonal centrifugation.

   Chromatography : Paper chromatography (two dimentional), factors affecting Rf. Gel filtration, Principle, different supporting media. Affinity Chromatography - Principle, ion-exchange

   chromatography - Principles of type.

   Electrophorosis - Principles of paper and gelelectrophorosis.

8. Techniques in Manometry. RQ, Gas constant, flask constant, Warburg apparatus, applications of Manometry.

REFERENCE BOOKS FOR NON CHORDATES

Protozoon Ultrastructure	-	D. Pitelka
Protozoology	-	P.R.Kude
Protozoology	-	R.P.Hall
The Trematoda	-	B.Dewas
Introduction to Protozoa	-	D. Mackinnon
The Mollusca	-	J.E.Morton
Presobranch Mollusca	-	K.M.Wilbur and C.M.Young
The Basic Arthropodan stock	-	A.G.Sharov
Physiology of Crustacea	-	T.H.Waterman
A Treatize on Zoology (Part-I-IX)	-	E.Ray Lankester (Ed)
Cambridge Natural History	-	S.F.Harmer and A.E.Shipley (Ed.)

Biology of Crustacea	-	J.Green
Palaeontology	-	Easton
Palaeontology	-	R.R.Shrock
Echinodermata	-	D.Nichols
Pogonophora	-	A.V.Ivanov
Implications of Evolution	-	G.A.Kerkut
The lower Metazoa	-	E.C.Dougherty
Students text books of Zoology Vol. I-III	-	A Sedgwick
The Invertebrates	-	L.H.Hyman

Vol.-I - Protozoa through Ctenophora
Vol.-II - Platyhelminthis - Rhyncoeoela
Vol.-III - Acanthocephala - Entoprocta
Vol.-IV - Echinodermata
Vol.-V - Smaller Coelomate Groups
Vol.-VI - Mollusca

REFERENCE BOOKS FOR BIOCHEMISTRY

Segar I.H. (1976) - Biochemical Calculation, 2nd, Edn. Wiley, New York willard, H.H.Merrit, LL and Dean, A.J. (1974) - Instrumental Methods of Analysis, 5th Edn. D.Van. Nostrand Co., New York.

Lehniger, A.L. (1976) - Biochemistry, 2nd Edn. Worth Publ. New York Mahler, H.R. and E.H. Cordes 1971, Biological Chemistry, 2nd Edn New York, Harper and Row.

Stryer, Lubert 1975 Biochemistry San Francisce, W.H.Freeman and Co Umbreit, W.W.R. Burris & J.F.Stauffer, 1957 Manomeric techniques. Menneapolics. Burgess.

Harper's Review of Biochemistry - Long Medical Publ. California (reprint) Biochemistry ediated by Zubay, Addison Weslay (1983), E.E.Conn. & P.K.Stumi (1978) - Out lines of Biochemistry, 4th Edn. G.H.Bell, D.Emalie. Smith and C.R. Paterson (1976) Text Book of Physiology and Biochemistry 8th Edn ELBS Livingstone.

ZOO 102 ENVIRONMENTAL BIOLOGY

1. Review of Ecology of natural systems : Biosphere, biotic and abiotic components, integration of biotic and abiotic factors, Food wed and trophic levels, carbon, nitrogen and phosphorous cycles.

2. Changes in Ecosystems : Succession, long range stability of ecosystems and of atmosphere.

3. Structure of freshwater community - Lakes - origin, vertical stratification, thermal exchange, dissolved gasses, salts etc. Plankton - Phyto and zooplanktons of lotic and lentic systems, seasonal fluctuations, productivity of freshwater ecosystem.

4. Structure of terrestrial community : Terrestrial permiants biomass, productivity.

5. Environmental adaptations : Structural and functional adaptations with reference to freshwater, marine, terrestrial, desert, snow biomass etc.

6. Air and water pollutions :

   a) Air pollution - Sources - industrial, vehicular, combustional. Effects on animals (including human) and plants. Prevention and control measures.

   b) Water pollution - Major industrial effluents, textile wastes, paper and pulp industry wastes, dairy waste, Brewery and distillary wastes, pharmacutical wastes, sugar industrial waste, Treatment for water pollution.

7. Radiation and Noise pollution :

   a) Radiation pollution - Sources - natural and artificial, hazards, evaluation and control.

   b) Noise pollution - Sources, effects on human, prevention.

8. Energy : Resources and consumption, energy crisis.

9. Human popullations : Defination, population, growth curves, natality and morality, world wide demographic trends, population density, poulation explosion and its impact on environment, population control.

10. Conservation of nature : Species and extinction of species - Destruction of habitat, introduction of foreign species, commercial harvest, predation, Action to save endangered species - Research and documentation, habitat preservation and development of wild life refuge, providing critical resources, legal actions for the preservation of species, breeding in captivity. A forestation.

REFERENCES :

1. Turk and Turk (1988) IV edn. Environmental Science. Saunders college Publishing N.Y.

2. Southwick V.H. (1976), Ecology and the quality of environment 2edn. Van Nostrand N.Y.

3. Sax N Irving : Industrial pollution, Van Nostrand Reinhold Company N.Y.

4. Nelson L. Nemerow : Industrial water pollution origins, characterstics and treatment. Addison weslay publishing company.

5. Trivedi R.K., Goel P.K., Trisal C.L. : Practical Methods in Ecology and Environmental Science. Environmental Publishers. Karad.

6. Bedi : Social and preventive medicine.

7. Benton A.H., Warner W.E. (1958) : Principles of field biology and ecology. Mc.Graw Hill.N.Y.

8. Odum E.P. (1971) : Fundamentals of Ecology 3rd Edn. W.B. Saunders Co.

9. Needham and Needham - A guide to the study of freshwater biology.

10. Welch (1952) Limnology

11. Tonapi (1980) Freshwater animals of India.

12. C.S.Rao (1995) Environmental Pollution Control Engineering Wiley Eastern Publication.

13. S.S.Dara : A Text Book of Environmental Chemistry and Pollution (1997) control. S.Chand and Company, New Delhi, India.

ZOO 103 (a) Chordate

1. Origin and Phylogeny of Chordate

2. Concept of adaptive radiation and application ot Chordate - fish (Elasmobranchii, Cateihthyes, Amphibia, Reptile, Aves, Mammals).

3. Study of Endoskeleton and Joints in any suitable mammal.

4. Comparative anatomy of autonomous nervous sytesm.

5. Comparative anatomy of sense organs - ear and eye.

ZOO 103 (b) Biostatistics

1. Introduction to Statistics -

   1.1 Meaning of Statistics.

   1.2 Its Uses in Biological Sciences.

2. Collection of Statistical Data -

   2.1 Concept of population, Sample, parameter, statistics primary and secondary data.

   2.2 Sampling procedures, Purpose of sampling.

   2.2 Sampling methods - SRSWOR, SRSWR, Stratified random sampling, Systematic sampling. (Mathematical derivations not expected).

3. Classification -

   3.1 Meaning, objects of classification.

   3.2 Class, Class limits, Class boundries, Mid points, class interval, Frequency, Cumulative frequency.

   3.3 Frequency distributions, Cumulative frequency distributions.

   3.4 Numerical Problem.

4. Measures of Central Tendency and Dispersion.

   4.1 Concept of Central Tendency and Deapersion.

   4.2 Mean, Median, Standard deviation, Definitions, Computations for grouped and ungrouped data. (by direct method using formulae)

4.3 Coefficient of variation : Defination, Computation and its uses.

4.4 Numerical problems.

5. Correlation and Regression -

5.1 Meaning of correlation and types of correlation Karl person's Coefficient of Correlation. Defination, Interpretation, Computation for grouped and ungrouped data.

5.2 Meaning of regression, statement of regression equations, for two varja, regression coefficient, computations of Regression equation from raw data and Summarised data, Relation between Regression Coefficient and Correlation Coefficient.

5.3 Simple Numerical Problems.

6. Testing of Hypothesis :

6.1 Meaning of Hypothesis, Null Hypothesis, Alternative Hypothesis, finding of standard values from the statistical table.

6.2 Test based on Normal distribution (two tailed tests) Large sample tests for testing mean, Difference of means, proportion and difference between the proportions.

6.3 Test based on distribution, Testing the mean, Difference in the means, Paired t-test.

6.4 Test based on X^2 (Chi-Square) distribution. Test of goodness of fit, Test of independence of attributes.

6.5 Test based on F - distribution for testing the variances.

6.6 Simple Numerical Problems.

7. Design of Experiments.

7.1 Concept and Meaning of design of experiments. Randamization, Replication, Local control.

7.2 Brief and elementary explanation of CRD and RBD.

7.3 Numerical Problems.

Reference Books for Chordata

1) Bellairs - Reptiles (Hutchinson)
2) Green - Anatomy of the Rat (Hafner)
3) Hyman - Comparative Vertebrate Anatomy (University of Chicago Press)
4) Jollie - Chordate Morphology (Reinhold / Affiliates East-West)
5) Kingsley - Comparative anatomy of the Vertebrates (Blackinston/ McGraw Hill).
6) Laglar, Bardach, Miller and Passino - Ichthyology (Wiley)
7) Newman - The Phylum Chordata (Macmillan)
8) Noble - The Biology of Amphibia (Dover)
9) Parker and Haswell - Text Book of Zoology Vol II (Macmillan)

10) Paranjape - The Anatomy of the Garden Lizzard (Calotes versicolor)(Boulenger) (University of Poona)
11) Prasad - Vertebrate Zoology (Kitab Mahal)
12) Romer - The Vertebrate Body
13) Taylor and Weber - Functional Mammalian Anatomy (Van Nostrand)
14) Walls - The Vertebrate Eye and Its Adaptive Radiation (Hafner).
15) Walter and Sayles - Biology of the Vertebrates (Macmillan)
16) Weichert - Anatomy of Chordates.
17) Young - The Life of Vertebrates (Oxford).
18) Young - The Life of Mammal (Oxford).

REFERENCE BOOKS FOR BIOSTATISTICS :

1) Statistical Methods : G.W.Snedecor and W.C.Cochran.
2) Vital Statistics : M. Orkin and R. Drogin.
3) Statistical Methods ; W.S.Dixon and F.Massey.
4) A Short Text Book of Medical Statistics : A Bradford Hill.
5) Fundamentals of Biometry : L.N.Balaam.

Practicals in Course ZOO 101 (a) Nonchordate

1. Morphology of nuclei in Protozoa - Amoeba, Paramoecium, Opalina, Vorticella, Euglena, Stentor etc.
2. Study of Acnidaria - Structure of Beroe, Pleurobranchia.
3. Minor Phylla - Classification as per theory course.
4. Study of Parasitic and Sedentary Crustaceans.
5. Study of Head appendages in Crustaceans.
6. Study of larvae of Echinoderms.
7.-9. Diesection of Grasshopper - Digestive system, Nervous system, Reproductive system. Mountings-mouth parts, spiracles.

Practicals in Course ZOO 101 (b) Biochemistry

1. Preparations of Acid/Alkali of given normality and its standardization.
2. Preparations of Buffer of given pH using pH meter.
3. Determination of concentrations of glucose by Colorimetric method.
4. Estimation of Tyrosine by Folin phenol method.
5. Determinations of pka values of glycine.
6. To separate amino acids by paper Chromatography.
7. Isolation of Casein from milk by isoelectric precipitation.
8. Isolation of egg albumen from egg white by Ammonium Sulphate precipitation.
9. Estimate Uric-acid from the Lizard/Bird excreta.
10. Estimation of Protein by Biuret method.
11. Estimation of Cholesterol (Acetic anhydrate method) DNA Fragments/Protein.
12. Quantitative determination of Total Nitrogen by Kjeldhal Method/Soresson's Method.
13. Determination of Creatinine in blood and Urine by Picric acid Method.

Practical Corresponding to ZOO 102 Environmental Biology :

1. Estimation of root biomass.
2. Determination of Chlorophy 'a' and 'b' of terrestrial plants by using Acetone method.
3. Estimation of O_2 and CO_2 from freshwater samples.

4. Estimation of total alkalinity, carbonates bi-carbonates, hardness.
5. Determination of physical properties of water - such as pH, temperature, total solids (TS), Total dissolved solids (TDS), light penetration by using sachi disc.
6. Qualitative analysis of Zooplankton of lotic ecosystem.
7. Qualitative analysis of Zooplanktons of lentic ecosystem.
8. Study of morphological, Physiological and protective adaptations of freshwater animals with suitable examples.
9. Study of morphological, Physiological and protective adaptations of terrestrial animals with suitable examples.
10. Study of instruments used in study of Environmental Biology PH meter, BOD incubetor, COD incubator, Colorimeter, Spectrophotometer, Flame photometer, turbidity meter, Environmental chamber (any three).

11. Biological assessment of water pollution (any three)
    a) Diversity index,
    b) Kothe's species deficit index
    c) Odum index
    d) Sequential comparison index (SCI)

12. Measurement of dust fall.
13. Field trip to study pond/lake as an example of lentic fresh water ecosystem.
14. Field trip to study river as example of lotic freshwater ecosystem.
15. Field trip to study terrestrial ecosystem and pollution affected area.

Practicals corresponding to ZOO 103 (a) Chordate

1) Classification of Pisces/fishes up to order, sub order Elasmobranchi, Cteichtyes, Dipnoi.
2) Classification of Amphibia up to order - suborder, Anura, Urodela, Apoda.
3) Classification of Reptiles up to order - suborder - Anapside, Diapside.
4) Classification of Aves up to order - suborder - Palaeognathae, Neognethae.
5) Classification of mammals up to order - suborder - Prototheria, Metatheria, Entheria.
6) Study of Axial skeleton of Rabbit/any suitable mammal.
7) Study of Appendicular skeleton of Rabbit/any suitable mammal.
8) Dissection of Rat/any suitable vertebrate to study criminal nerves
9) Dissection of Rat/any suitable vertebrate to study criminal nerves autonomic nervous system.
10) Study of eye muscles in any suitable vertebrate.

Practical corresponding to ZOO 103 (b) Biostatistics

1) Formation of Frequency distribution and Computation of central Tendency and Dispersion.
2) Drawing a random sample from the population by using Random Number table.
3) Computation of Regression equations.
4) Determination of Regression equations.
5) Test of Significance (Large sample tests)
6) Test of Significance (Small sample tests)
7) Analysis of CRD and RBD and its interpretation.

ZOO 201 (a) General Physiology

1. Excretion : Physiology of excretion w.r.t. desert animals.
2. Respiration: Blood pigment Haemoglobin and its metabolism.
3. Circulation: Laws of Haemodynamics, Blood coagulation, ECG Normal and abnormal, its significance.
4. Muscle Contraction : Types muscle contractions - Simple muscle twitch, isometric and isotonic contraction.
5. Temperature relations : Adaptations to temerature in poikilotherms and thermal acclimatization.
6. Pineal gland structure and function.
7. Physiology of Tactile, Gustetory and olfactory receptors.
8. Electro Encephalogram (EEG) - Its significance sleep, Memory.
9. Immune System in Human.

ZOO 201 (b) Writing Scientific reports and oral presentation in English.

1. Compilation of Experimental Record :
   Writing helps you remember, observe and think,
   Writing an account of an experiment during its progress,
   Writing a progress report.

2. Communication : Internal reports, letters and memorands
   Communication as part of science.

3. How Scientists should write :
   Explanation, clarity, completeness, impartiality, order, accuracy, objectivity, simplicity, appropriateness, balance, brevity, consistancy, control interest, persuasiveness, precision, sincerity, unity.
   How to write instructions
   Unscientific writing examples

4. Pregramme of writing :
   Thinking and planning - information, ideas, topic, outline, order of paragraph writing, revising.

5. Use of Vocabulary :
   Meaning of words, precise usage, tautology, synonyms, unnecessary qualification of word, ambiguity.
   Technical terms, nomenclature.
   Context, superfluous words, circumlocution, reason for verbosity.

6. Use of good English :
   Noun, pronoun, verb, adverb, adjective, conjuction, articles, tenses, spelling etc.

7. Helping the reader :
   Decide what the reader needs to know.
   Write for easy reading (how to begin, control, explain, sentence length, rhythm, style)
   Capture and hold reader's interest.
   Obstacles to effective communication.

8. Numbers contribute to precision :
   The use of numbers.
   The use of tables.
   The use of graphs and diagrams.

9. The art of illustrations, ink drawing, photography.
Writing the legend or caption.
Completed illustration.

10. Reading :
How to read, making notes as you read, writing a book review.

11. The part of a research report :
Introduction, M/M Results, Discussion, Summary, Acknowledgement, Reference.

12. The part of thesis and project reports :
Preparing the manuscript.
Preparing the typescript.
Preparing the index.
Preparing the typescript for the printer.

13. Editing and correcting :

14. Technique of Oral Presentation :
Preparation of summary notes, choice and use of audiovisual techniques. Voice, pronounciation, punctuation, articulation, speed of delivery. Justification, interest, brevity, directness, sequence emphasis, citations, tautology.
The time factor.
Hypothesis/analysis and synthesis.
Questions and answers - Listening, attentiveness, circumlocation.

ZOO 201 (b) Economic Zoology

Study of the following topics in relation to their economic importance

Protozoa: i) Parasitic protozoa - E. histolytica, Trypanosoma, Leishmania and Malarial parasite.

ii) Soil protozoa - Psentomonas, Euglena their role in agriculture.

Porifera: Sponge culture and its importance in industry and commerce.
Coelenterata : Coral reefs as barriers their industrial and medicinal uses.

Annelida : Economic importance of Earthworms :

i) Worm framing, ii) Vermi compost, iii) Natural plonghing.

Arthropoda :

i) Prawn fisheries, ii) Silkworm,
iii) Honey bees, iv) Lacinsets
v) Termites, vi) Ticks and mites,
vii) Insect vectors viz. Heas, Housefly, Mosquitoes culex, anopheles.

Mollusca :
i) Pearl industry, ii) Ornamental value of Mollusca
iii) Shell industry iv) Food sources
v) Role as intermidiate hosts (Bionomics not needed)

Echinodermata :

Harmful role of star fishers in Oyster farming Ornamental value.

Cyclostomes and Fishes :

i) Parasites and Predators ii) Food value
iii) As fertilizers iv) Fish glue
v) Oil vi) Medicinal uses
vii) Ornamental uses.

Amphibia :

i) As Biological control agents.
ii) Food value
iii) Role as experimental animals for research.

Reptiles :

i) Role of Snakes as Biological control agents.
ii) Antivenom production.

Aves :

i) Poultry birds. ii) Birds as pests
iii) Birds as pollinators iv) Birds as Biological Control Agents.
v) Nuisance value in aviation.

Mammals :
i) Dairy industry
ii) Piggery
iii) Hide, ivory, wool, bone industries.
iv) Goatary
v) Mammalian pests - Pigs, rats, Bandicoots. squirrels, bats, mamls viz.
vi) Role of Guineapigs and Monkey as animals for research.

Reference Books - ZOO 201 (a) General Physiolgy

1. K.Schmidt - Nielsen (1979) - Animal Physiology : Adaptation and environment, Cambridge University Press.
2. C.L.Ralph (1978) - Introductory Animal Physiolgy, McGraw-Hill.N.Y.
3. E.Baldwin (1964) - Introduction to Comparative Biochemistry, Cambridge University Press.

Reference Book -

ZOO 201 (b) Writing Scientif Reports and Oral Presentation in english.

1. Scientist Must Write, R.Narrass, (1978), Chapman and Hall, John wiley and Sons, N.Y.
2. Writting Scientific Papers in English (1975), Maeve O'Connor and F.Peter Woodford, Elsevier, Excerpta Medica. North-Holland.
3. The art of plain talk, Flesch, R.F. (1962), Collier - Macmillan, London, N.Y.
4. Guide for preparation of scientific paper for publicaiton and Guide for preparation of author's Abstract for publication, UNESCO (1968) SC/MD/5, Vallins, G.H. (1964) Good English; How to write it.

5. Grogan D.J., Science and Technology : An introduction to the literature 2nd ed., Bingley Publication London.
6. Elements of English Grammar.
7. Oxford and Webster's English Dictionaries.
8. English in Basic Medical Science, by Joan Maclean (1978) Oxford Uni. Press.
9. English in Education, by Elizabeth Laird (1977), Oxford Univ. Press.

References Book - ZOO 201 (b) Economic Zoology.

1. Economic Zoology - by Srivastava, Commercial Publication, berue, New Delhi.
2. Economic Zoology - by Fred V. Theobald
3. Economic Zoology - by Vishwapremi K.K. Akashdeep Publishing House, New Delhi
4. Parasitology - by K.D.Chatarjee
5. Parasitology - by Kudo
6. Useful and Destructive Insects by - Metrall and Tennt.
7. Hyman Series - Common Birds - Salim Ali
8. Indian Birds - Salim Ali
9. Indian Snakes - Dr. Deoras
10. Fishes of India - Dry Faucis
11. Zoology Phylum series - Kotpal R.L.
12. Life of Mammals - Young.

ZOO 202 - Cellular and Development Biology

1) Plasma membrane - Structure, chemical nature, models, passive and active transport, junctions, changes in membrane due to fertilization.
2) Chloroplast - Ultra structure and functions
3) Lysosome - Ultra structure and functions.
4) Mitochondria - Ultra structure and enzymes with functions.
5) Ribosomes - Structure and functions in brief.
6) Cell cycle - Methods of analysis and regulation. Control of cleavage pattern during development.
7) Mitosis and Meiosis - Mitotic apparatus, centrioles, Synaptonemal complex.
8) Concept of Growth - At cellular and organ level.
9) Cellular differentiation - Concept, totipotency, genic control of differentiation.
10) Eye morphogenesis.
11) Transformation, transdetermination and transdifferentiation, concogenes.
12) Limb development and limb regeneration.
13) Nucleocytoplasmic interactions, somatic cell hybridization, clonning.
14) Cellular immunity.
15) Cell ageing and cell death.

Reference Books - ZOO 202 - Cellular and Developement Biology.

1) Cell Biology - De Robertes et. al. 1975.
2) Cell and Molecular Biology : DuPraw E.J.
3) Gene expression : Lewin B.
4) Molecular Biology of the Gene : J.D.Watson
5) Mitochondrian : Lehninger B.
6) Membrane of Mitochondria and Chloroplast : Racker.
7) Cell fusion : Harris.
8) Cytological technique : J.R.Baker 1966.

9) Atlas of fine structure : Fawcett D.M.
10) Development aspects of cell cycle : Cameron I.L.
11) Lysosomes and cell function : Pitt
12) The cell nucleus : Busch.H
13) Developmental Biology by Gilbert.

ZOO 203 (a) Molecular Biology and Biotechnolgy

1. Theories of crossing over - Molecular basis of recombination and repair.
2. Regulation of Gene action - End product inhibition, enzyme repression and induction, Lactose system in E.Coli, Operon concept.
3. Organisation of eukaryotic genes - haemoglobin Ig G, rDNA, Organisation of transcriptional unit in bacteriophage T_7 and eukaryotes
4. Transcription and processing of rDNA and mRNA, DNA replication, DNA - Polyerases, PCR technique.
5. Protein synthesis mechanism of protien synthesis.
6. Biotechnology - Defination, culture methods, - Genetic engineeringaims and techniques, Application of Genetic engineering techniques.
7. Cell and tissue culture techniques and its applications.

ZOO 203 (b) - Genetics

Recapitulation of principles of genetics.
Pleiopropism, position effect, penetrance and expressivity and concept of dominance. Balanced lethal systems.

Inbreeding and heteresis.
Genes in population gene frequencies, genetic diversity, Hardy-Weinberg law, changes in gene frequencies in population due to mutation and migration, Effects of non-random mating inbreeding and genetic and drift.
Role of Mutation in speciation.
Conjugation and transformation in bacteria
Structure and lifecycle of a bacteriophage (T2 and T4), virulant and temperature phages, lysogeny, transduction and zygotic induction.
Phage mutants and their importance. Fine structure of gene with reference to rII region.

RNA Phages and tumor viruses and their lifecycles.
Life cycle of Neurospora. Tetrad analysis.

Reference Books - ZOO 203 (b) Genetics

Dobzhansky, T : 1970. Genetics of the Evolutionary Process, Columbai University Press, N.Y.

Falconer, D.S.: 1961, Introduction to Quantitative Genetics, Longman, London.

Fincham, J.R.S. and Day : Fungal Genetics

Hayes, W. : 1975, The Genetics of Bacteria and Viruses Studies in Basic Genetics and Molecular Biology, Blackwell, Scientific Publications, Oxford.

Lewin, B. : 1973, Gene Expression, Vol. 1 & 3, Wiley and 1978, Interscience Publ.

Shorrock, B : 1978, The Genetics of Diversity, Holder and Stoughton, London.

Strickberger, M.W. : 1976 Genetics, Macmillan, New York.

Whitehouse, H.L.K. : Towards an Understanding of the Mechanism of Heredity
The English language Book Society and Edward Arnold.

Practical w.r.t. ZOO 201 (a) General Physiology

1. To determine the chlorides in the blood of human and crab.
2. Determination of nitrogenous excretory products.
   (Urine, sample of Cow, excreta of cockroach, lizzard, bird)
3. To make a muscle nerve preparation to record muscle twitch in suitable animals.
4. Effect of temperature on oxygen consumption in crab
5. To estimate the amount of chloride present in the urine of a mammal (Cow).
6. Effect of adrenaline on liver and muscle glycogen of Rat.
7. Preparation of neuro-motor end plates in any suitable animal.
8. Study of reflex action in any suitable animals.
9. Circulatory response in Human skin.
10. Quantitative estimation of blood sugar level, before and after insulin treatment.

Practicals of Zoo-202 : Cellular and Developmental Biology

1. Study of electronmicrographs of various cells organelles
2. Stud of principles of phase contrast, electronmicroscopy
3. Study of mitosis in onion root tip/Rhea polen
4. Study of meiosis in Grasshopper testes
   (Special attention for prophase I stages)
5. Preparation of chromosomes from bone marrow cells of Rat
6. Detection of carbohyderates (mucopolysacchrides and glycogen) by PAS reaction
7. Detection of protein by Bromophenol blue method.
8. Detection of DNA by Feulgan reaction
9. Detection of mitochondria in tissue sections
10. Detection of RNA by Methyl green pyronin method
11. Determination of chlorophyll pigments by acetone method
12. Temporary preparation of chick embryo
13. Permanent preparation of chick embryo
14. Study of different types of eggs
15. Study of cleavage patterns in Amphioxus, fish, snail, frog, bird and mammals.
16. Study of Gastrulae in Ambhioxus, fish, frog, bird and mammal
17. Study of cell death with suitable material
18. Study of regeneration in hydra/planeria.

Practicals of ZOO-203 (a) Molecular Biology and Biotechnology

1. Study of various techniques and instruments used in Subcellular fraction and colorimetry and Beer's law.
2. Estimation of total protein content in different cell fractions (Nuclear, Crude Mitochondrial) by Lowry's Method.

3. Isolation of DNA/RNA from biological sources.
4. Estimation of DNA by Diphenylamine reaction from different cell fractions
5. Determination of RNA by Orcinol reaction in given cell fractions
6. Determination of sucrose/glycerol density gradient and centrifugation.
7. Lysosomal/Protase activity in liver homogenate and sub-cellular fractions
9. Visit to a biotechnology lab/tissue culture lab.

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Practicals of ZOO-203 (b) Genetics

1. Study of external morphology and sexual dimorphism of Drosophila malanogaster - normal & mutants.
2. Study of monohybrid cross and ratio in D. malanogaster
3. Calculation of gene frequency of PTC testing in the given human population and study of its pedgree.
4. Study of some sex linked characters of D. melanogaster - white eye, bar eye.
5. Study of genetic diversity in some morphological characters of D. malanogaster.
6. Calculation of gene frequency of A,B, O blood group in the given human population.
7. To detect synaptic pairing of chromasomal abberation in meiotic stages (Prophase-I) of Gasshopper/testes.

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J/ws/syll/mszoo