C. ABDUL HAKEEM COLLEGE

Melvisharam, Vellore Dist- 632509, TN, India

Telephone : +91 4172 266487, 266987 | **Fax :** +91 4172 266587

Web : www.hakeemcollege.com

SUBJECT LIST

Course M.Sc - Zoology

Batch 2015-2016

Total Credits 90

S.No	E/D	Cate.	Type	S. Code	S. Name	I.Ma	I.Mi	E.Ma	E.Mi	P M	Cr	Pt
Semester - 1					**Subject Count - 4**			**Total Credits - 15**				
1	E	Theory	Main	P15MZL101	Life and Diversity of Invertebrates	25	0	75	38	50	4	III
2	E	Theory	Main	P15MZL102	Life and Diversity of Chordates	25	0	75	38	50	4	III
3	E	Theory	Main	P15MZL103	Cell and Molecular Biology	25	0	75	38	50	4	III
4	E	Theory	Elective	P15EZL101	Biostatistics and Bioinformatics (Elective)	25	0	75	38	50	3	III
Semester - 2					**Subject Count - 8**			**Total Credits - 30**				
1	E	Theory	Main	P15MZL201	Genetics	25	0	75	38	50	4	III
2	E	Theory	Main	P15MZL202	Environmental Biology	25	0	75	38	50	4	III
3	E	Theory	Main	P15MZL203	Bio Technology	25	0	75	38	50	4	III
4	E	Theory	Elective	P15EZL201	Biochemistry (Elective)	25	0	75	38	50	3	III
5	E	Practical	Main	P15MZLP21	Practical - I Life and Diversity of Invertebrates, Chordates, Cell and Molecular Biology	40	0	60	30	40	5	III
6	E	Practical	Main	P15MZLP22	Practical - II Genetics, Environmental Biology and Biotechnology	40	0	60	30	40	5	III
7	E	Practical	Elective	P15EZLP21	Elective Practical - I Biochemistry	20	0	30	16	20	3	III
8	E	Theory	Main	P15CHR201	Human Rights	25	0	75	38	50	2	VII

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SUBJECT LIST

Course M.Sc - Zoology

Batch 2015-2016

Total Credits 90

S.No	E/D	Cate.	Type	S. Code	S. Name	I.Ma	I.Mi	E.Ma	E.Mi	P M	Cr	Pt
Semester - 3					**Subject Count - 4**			**Total Credits - 15**				
1	E	Theory	Main	P15MZL301	Animal Physiology	25	0	75	38	50	4	III
2	E	Theory	Main	P15MZL302	Developmental Biology	25	0	75	38	50	4	III
3	E	Theory	Main	P15MZL303	Immunology	25	0	75	38	50	4	III
4	E	Theory	Elective	P15EZL301	Biophysics (Elective)	25	0	75	38	50	3	III
Semester - 4					**Subject Count - 7**			**Total Credits - 30**				
1	E	Theory	Main	P15MZL401	Research Methodology	25	0	75	38	50	5	III
2	E	Theory	Main	P15MZL402	Evolution	25	0	75	38	50	4	III
3	E	Theory	Main	P15MZL403	Entomology	25	0	75	38	50	5	III
4	E	Theory	Elective	P15EZL401	Sericulture (Elective)	25	0	75	38	50	3	III
5	E	Practical	Main	P15MZLP41	Practical - III Animal Physiology, Developmental Biology and Immunology	40	0	60	30	40	5	III
6	E	Practical	Main	P15MZLP42	Practical - IV Research Methodology, Evolution and Entomology	40	0	60	30	40	5	III
7	E	Practical	Elective	P15EZLP41	Elective Practical - II Sericulture	20	0	30	16	20	3	III

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Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15MZL101 Semester : I

Major - 1 Title: **Life and Diversity of Invertebrates**

Credits: 4 Max. Marks. 75

OBJECTIVES

To comprehend the systematic position, functional morphology, mode of life, affinities and biodiversity of invertebrates.

UNIT-I

Broad classification of the Animal Kingdom - Principles involved.

Protozoa

Feeding, Reproduction and Parasitic Protozoa
Economic importance of Protozoa
Origin and evolution of Metazoa - theories.
Mesozoa

Porifera

Interrelationship between different classes,
Marine sponges.
Freshwater sponges.
Skeleton Sponges.

UNIT-II

Cnidaria

Origin and evolution, Polymorphism and Reproduction in cnidaria .
Corals and Coral reefs

Origin of Bilateria

Importance of Rhabdocoela as a stem group. Origin and evolutionary trends in coelom formation.

Platyhelminthes

Functional morphology and adaptive biology for parasitic mode of life.

UNIT-III

Annelida
Archiannelida. Interelationship between different classes of Annelida. Adaptive radiation in Annelida.

Arthropoda
Economic importance of Crustaceans
Phylogeny of Arthropoda, Xiphosura-structure and affinities.

UNIT-IV

Mollusca
Molluscan phylogeny, Monoplacophora - Torsion in Gastropoda - Adaptive radiation in Mollusca

Echinodermata
Origin & Phylogeny of Echinoderms.

UNIT-V

Minor Phyla
Structural peculiarities and affinities of Ctenophora, Nemertinea, Rotifera, Pogonophora and Phoronida

Invertebrate fossils
Trilobites, Brachiopoda, Cephalopoda and Echinodermata.

REFERENCE BOOKS

1. Barnes. R.D. 1974 Invertebrate Zoology. W.B. Saunders Co.,Philadelphia.

2. Hyman L.H. 1951 The Invertebrata, Vol I to VI. Mc Graw – Hill Book Co., New York.

3. Carter, G.S.A. 1969. General Zoology of Invertebrates. Sidewick and Jackson Ltd., London.

4. Borradile, L.A. Eastham, L.E.S. and J.T. Saunders. 1977 The Invertebrate Cambridge University Press.

5. Barrington, E.J. W. 1969. Invertebrate Structure and Functions. English Language Book Society.

6. Moore, R.C. Lalicker, C.G. and Fisher, A.G. 1952 Invertebrate Fossils. Mc Graw Hill Book Co., New York.

7. Gardinar, M.S. 1972 Biology of the Invertebrates, McGraw - Hill Book Co., New York.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15MZL102 Semester : I

Major - 2 Title: **Life and Diversity Chordates**

Credits: 4 Max. Marks. 75

OBJECTIVES

To comprehend the systematic position, functional morphology, mode of life, affinities and biodiversity of chordates.

UNIT-I: TAXONOMY

Principles of taxonomy

Nomenclature- Binomial, Trinomial nomenclature.

Suffix as for super family name-(oidea), familyname (idea), use of suffixes 'i', 'orum', 'ae', 'arum', 'ensis' and 'iensis'.

Tautonyms synonyms and Homonyms.

New trends in taxonomy: Ecological approach, Ethological approach, Cytological approach, Biochemical approach and Numerical taxonomy.

Taxonomic key: Indented, Simple non-Bracket Grouped type, combination

Pictorial: Branching type, Circular and Box-type.

UNIT-II

Prochordate phylogeny - systematic position of Prochordates

Ostracoderms: Silurian and Devonian Ostracoderms. Evolutionary position of the Ostracoderms.

Placoderms: Origin of Jaws- Placoderms as ancient "experiment" in the evolution of the jawed vertebrates.Structural peculiarities of Cyclostomata.

UNIT-III

Chondrichthyes: Fossil history of chondrichthyes, tendencies in Elasmobranch evolution.

Actinopterygii: Origin and evolution, Adaptive radiation of bony fishes.

Amphibia: Origin and evolution of Amphibia.

UNIT-IV

Reptilia: Evolution of Reptilia. Saurischian and Ornithischian Dinosaurs -Rhyncocephalia - Adaptive radiation of Reptiles.

Aves: Birds as glorified reptiles. Fossil history of birds. Palate in Birds. . Adaptive radiation in birds.

Mammal: Evolution of Mammals, Structural peculiarities of Prototheria, Metatheria and Eutheria.

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UNIT-V

Comparative anatomy: Origin and evolution of the vertebrate integumentary system. Paired fins and limbs, heart and aortic arches and brain of vertebrates.

REFERENCE BOOKS

1. Waterman. A.J. 1971. Chordate Structure and Function. McMillan Co. London.
2. Jolie, M. 1968. Chordate Morphology. East West Press. Pvt, Ltd,
3. Romer, A.S. and Parson, T.S. 1978 Vertebrate Body. W.B. Saunders Co.,Philaelphia.
4. Young, J.2.1969. Life of Vertebrates. Clarendon Press, Oxford.
5. Colbert, E.H. 1969. Evolution of Vertebrates. John Wiley and Sons Inc, New York.
6. Holstead. 1969 The Pattern of Vertebrate Evolution. Freeman and Co. San Francisco. U.S.A.
7. Hobart M. Smith, 1960 Evolution of Chordate Structure, Holt, Rinehart and Winston. Inc. New York.
8. Kapoor, V.C. 1998 Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing Co., Pvt, Ltd. New Delhi.
9. Hyman, L.H. 1966. Comparative Vertebrate Anatomy. The University of Chicago Press, Chicago.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15MZL103 Semester : I

Major - 3 Title: **Cell and Molecular Biology**

Credits: 4 Max. Marks. 75

OBJECTIVES

To understand the structure and molecular basis of cellular interactions, energy transformation, regulation and control of genes, cell cycle and information transfer.

UNIT-I: STRUCTURE AND FUNCTIONS OF CELL ORGANELLES

Plasma membrane: Membrane associated receptors, Membrane transport - Membrane Potentials - Extracelllular space - cell adhesion, intercellular recognition - Intercellular junctions. Mitochondria - energetics - Control of cellular respiration - Biogenesis and mitochondrial replication.

UNIT-II: NUCLEUS

Nuclear - cytoplasmic interactions. Nuclear receptors, Nuclear transplantation - Cell fusion: homokaryons, heterokaryons. Cytoplasts and karyoplasts.
Structure and function of Chromatin - Organisation of nucleosomes - Euchromatin and heterochromatin - Polytene and lambrush Chromosomes

UNIT-III: CELL CYCLES

Cell cycles - its components GO-G 1 transition - Spindle organization - Chromosome movements - Regulation and synchronization of cell division.
Cancer cell: Differences between normal and cancer cell- structural and functional characteristics -Tumour Viruses-Oncogenes - Environmental factors inducting cancer. Hormones in relation to cancer-Theories of carcinogeneis.

UNIT-IV: INFORMATIONAL MACROMOLECULES

Chemistry of DNA - Polymorphism of DNA - Mechanism and enzymology of DNA replication - DNA repair mechanisms.
Chemistry of RNA - Different types of RNA and their functions.

UNIT-V: INFORMATION TRANSFER
Information transfer in Prokaryotes; information transfer in Eukaryotes. Transcription - Promotors - Initiators and terminators - Transduction. RNA processing - Trimming of introns and splicing of exons.

REFERENCE BOOKS

1. De Robertis. E.D.F. and De Robertis. E.M.F. 2001. Cells and Molecular Biology, B.I Publications Pvt Ltd, India.
2. Lewin, B.2000 Genes VII. Oxford University Press, New York.
3. Howland J.L. 1973. Cell Physiology, McMillan Publishing Co., New York.
4. De Witt, 1977. Biology of the cell. An evolutionary approach. Saunders Company.
5. Karp, G. 1979. Cell Biology. McGraw Hill Ltd., Japan.
6. Avers. C.J., 1976. CellBiology. Van Nostrand Company, New York.
7. Korenberg. A. 1974. DNA Replication. Dorothy- W.H. Freeman and Company, San Francisco.
8. Hawkins, J.D.1996. Gene Structure and Expression, Cambridge University Press, London.
9. Shanmugam, G., 1988. A laboratory manipulation in fish. Madurai Kamaraj University.
10. Albert, B and Watson. J.D. 1990. Molecular Biology of the cell. Garland Publishing, London.
11. Malacinski, G.M. 2005. Essentials of molecular biology. Narosa Publish House, Chennai.
12. Lodish, H., Berk A .,Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipursky, S.L.and Darnell, J. 2004. Molecular Cell Biology. W.H. Freeman & Co., New York.

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Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15EZL101 Semester : I

Elective-1 Title: **Biostatistics and Bioinformatics (Elective)**

Credits: 3 Max. Marks. 75

OBJECTIVES

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

UNIT-I: INFERENTIAL STATISTICS

Introduction: Definition of statistical population and sample in biological studies. Variables: qualitative and quantitative, Discrete and continuous.
Probability; Basic principles - apriori and aposteriori probabilities - addition and multiplication rules of probability. Conditional probability. Theoretical distribution, normal binomial and Poisson - application.

UNIT-II

Hypothesis testing - Null hypothesis - levels of significance - degrees of freedom - type I and type II errors.
Test of significance: Chi-square test for goodness of fit, homogeneity and association between attributes (Problem relating to Genetics, patterns of distribution etc. to be worked out.
Test of significance for large and small samples - comparison of sample mean with population mean comparison of two - sample (computation required)

UNIT-III: CORRELATION AND REGRESSION

Correlation: definition and types - simple, multiple -partial, linear, nonlinear, mutual, cause and effect etc.
Uses of scatter diagram and correlation graph in the study of correlation between two variables. Computation of Karl Pearson's co-efficient of correlation - testing its significance, Interpretation. Regression analysis - properties - application. ANOVA - Applications.
Population Statistics -Vital statistics - natality and morality rates. Population estimation - population growth.

UNIT-IV: BASIC BIOINFORMATICS

Bioinformatics - Biological Database - Servers for Bioinformatics (NCBI, EBI, Genoment) Virtual Library - Data mining - Data Warehousing - Searching techniques - Genomics - Proteomics.

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UNIT-V: ALGORITHM IN BIOINFORMATICS

Algorithm and tools sequence analysis - Similarity Search - Biomolecular visualization - Phylogenetic analysis - Drug designing. FASTA,BLAST.

REFERENCE BOOKS

1. Milton, J.S 1992 Statistical Methods in Biological and Health Science. McGraw-Hill Inc, New York.
2. Schefler, W.C. 1963 Statistics for biological sciences. Addition - Wesely Publication Co., London.
3. Snedecor, G. Wand Cocham, W. G. 1967 Statistical Methods. Oxford Publication Co., New Delhi.
4. Spiegel, M.R. 1981 Theory and problems of statistics, Schaum's Outline Series McGraw -Hill International Book Co., Singapore.
5. Pillai, R.S.N. and Bagawathi, V.2005 Statistics. S. Chand & Co.Ltd, New Delhi.
6. Stansfield,W.O. 1984 Theory and Problems of genetics(including 600 problem) Schaum's outline series.McGraw - Hill Book, Co., New York.
7. Sokal,R.R.and Rohlf, F .J 1969 Biometry.The Principles and Practice of Statistics in Biological Research.W.H.Freman and Co.,San Francisco.
8. Mahajan, B.K. 1984. Methods in Biostatistics for Medical students and researchWorkers. Smt. Indu Mahajan, New Delhi.
9. Gupta, S.P. 1988. An easy approach to statistics. Chand & Co., New Delhi.
10. Westhead, D.R., Parish, J.H. and Tugman, R.M. 2003 Bioinformatics. Viva Books Pvt. Ltd., New Delhi
11. Arthur, M.L. 2003. Introduction to Bioinformatics Oxford University Press, New Delhi.
12. Higggins D.and Taylor, W. 2000 Bioinformatics: Sequence, Structure and Databanks. Oxford University Press, New Delhi.
13. Durbin, R., Eddy, S.R., Krogh, A. and Mitchison, G. 1998. Biological sequence Analysis.Cambridge University Press, Cambridge, U.K.
14. Baxevanis, A. and Ouellette, B.F. 1998. Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley Interscience, Hoboken, New Jersey, USA.
15. Arthur M. Lesk. 2006. Introduction to Protein structure. Oxford University Press, New Delhi.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15MZL201 Semester : II

Major - 4 Title: **Genetics**

Credits: 4 Max. Marks. 75

Objectives

To understand the fine structure of genetic materials and regulation of their action. To know the chromosomal basis of genetic disorders, development and differentiation. Also, to know the importance of population genetics and nuances of genetic engineering and applied genetics.

UNIT-I: MOLECULAR STRUCTURE OF GENETIC MATERIAL

Molecular structure of DNA and RNA - Replication, theories, Gene concept - One gene one polypeptide concept.
Identification of DNA and RNA as the genetic material.
Microbial Genetics - Conjugation, transformation and transduction and
Sexduction.
Chromosome mapping in prokaryotes (Virus, Bacteria) and eukaryotes (Neurospora, and Man)

UNIT-II: REGULATION OF GENE ACTION

Enzyme regulation of gene action. Gene regulation of gene action - Operon concept - GAL and LAC Operon system. Evidence of regulation of gene action.
Genes and metabolism. Inborn errors of metabolism in Man (With reference to protein, carbohydrates, Lipid and nucleic acid metabolism).

UNIT-III: CHROMOSOME AND GENETICS DISORDERS

Evolution of sex chromosomes. Dosage compensation - X inactivation. Geneomic imprinting. Human Genetics. Normal human karyotype - Vriations in karotypes (autosomal and sex chromosomal, structural and numerical) with special reference to classical syndromes in man. Principles and methods of pedigree analysis - statistical evaluation. Genetic counselling - Objectives, ethics and principles . Methods of counselling for point mutation, disorders, structural and chromosomal disorders.

UNIT-IV: GENES IN DEVELOPMENT, RADIATION GENETICS AND POPULATION GENETICS

Genes in development and differentiation Mechansim of chromosomal breakage - physical chemical and biological factors or agents. Mutagens and mutagenesis and carcinogenesis - genetic changes in Neoplasia in man

Population genetics: Population and gene pool. Hardy Weinberg Law-Genetic equilibrium. Calculation of gene frequencies for Autosomal (Complete dominance, codominance and multiple alleles) and sex linked genes. Factors affecting Hardy Weinberg equilibrium.

UNIT-V: GENETIC ENGINEERING AND APPLIED GENETICS

Genetic Engineering - Restrictive enzymes - Recombinant DNA techniques. Applications of Recombinant DNA technology.
Applied Genetics - Application of genetics in animal breeding. Application of genetics in Crime and Law - DNA fingerprinting, Genetic basis of inteiligence. Studies on Twins.

Reference Books

1. Watson. J.D. Hopkins, N.H.., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1987 Molecular Biology of the Gene. W.A. Benjamin/Cummings Co., New York.
2. Sinnot. E.W., Dunn. L.C., Dobzhansky, T.H. 1973. Principles of Genetics. McGraw Hill Co., New Delhi.
3. Daniel L. Hartl. 1994. Geneties. Jones and Barflaff Publishing, Boston.
4. Lewin, B. 2000. Genes VII. Oxford university Press, New York.
5. Ayala, F. I. and Kieger, J.A. Jr., 1980, Modern Genetics. The Benjamin Publishing Co. London,
6. Goodenough, U. 1984. Genetics. Saundes College Publishing Co., London.
7. Curs Sten 1973 Principles of Human Genetics. W.H. Freeman and Co., New York.
8. Jenking, J.B. 1983. Human Geneties. The Benjamin Cummings Publishing& Co ., Londan.
9. Market, C.L. & Ursprung, 1973. Development Genetics, Prentice Hall.
10. Gardner E.J. Simmons, M.J. and Snustad, D.P.1991 John Wiley & Sons, New York.
11. Tamarin, R.H. 1996. Princples of Geneties, WCB Publishers Munro.
12. Stickberger, M.W. 1985. Genetics. Printice – Hall of India, Pvt. Ltd., New Delhi.
13. Pandian, T.J. and Muthukrishnan, J. 1988. Workshop on Research Methods for Chormosomal Manipulation in Fish. Department of Biotechnology Govt. of India, New Delhi.
14. Pandian, T.J. and Muthukrishnan, J. 1990. Research Methods for Gene and Choromosome Manipalation in Fish. Department of Biotechnology, Govt. of India, New Delhi.

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Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15MZL202 Semester : II

Major - 5 Title: **Environmental Biology**

Credits: 4 Max. Marks. 75

Objectives

To generate up-to-date knowledge on environmental conservation and management through a comprehensive understanding of the components of ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management.

UNIT-I: ECOSYSTEM AND COMMUNITY

Review of concept of ecosystem - Natural and Man-made ecosystem, with examples. Energyflow - Trophic structure and levels - Pyramids, food chain and web - ecological efficiencies, and productivity and its measurement. Definition, nature and flux of energy through communities. Influence of competition, pradation and disturbances - Community succession - homeostasis.

UNIT-II: POPULATION AND BIOLOGICAL CYCLES

Structure and distribution - Growth curves and pyramids - Groups, natality, Mortality - Density indices, Life study tables - factors affecting population growth - Carrying capacity. Population regulation and human population control. Complete and incomplete biogeochemical cycles - Sedimentary cycle - Recycle pathway of elements – Bio-geo Chemical Cycles – Carbon, Phosphate & Nitrogen.

UNIT-III: HABITAT AND RESOURCES ECOLOGY

Major Biomass, Adaptations with reference to physico - chemical features of environment of coastal ecosystems. Renewable and non - renewable resources - animal resources. Conventional and non - conventional energy sources.

UNIT-IV: ENVIRONMENTAL CONSERVATION AND MANAGEMENT

Principles of conservation - Rain water harvesting - Soil health and fauna inputs in agricultural Biosphere reserves - wildlife conservation and management. Biodiversity - Germplasm conservation and cryopreservation. Social forestry - tribal welfare.

UNIT-V: POLLUTION AND MANAGEMENT

Environmental pollution and its biological effects. Air, water, soil and noise pollution. Biological indicators and their role in environmental monitoring.

Reference Books

1. Odum. E.P. 1996 Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.

2. Trivedi, P.R.and Gurdeepraj, K. 1992. Environmental Biology. Akashdeep Publishing House New Delhi

3. Berwer. A.1988 .The Science of ecology. Saunder's college publishing.

4. Bandopadhyay, J.1985. India's Environment Crisis and response. Nataraj Publishers,Dehra Dun.

5. Smith, R.L.1986. Elements of Ecology. Harpet and Row Publishers, New York.

6. Ismail, S.A.1997. Vermicology, Biology of Earthworms. Orient Longman, Chennai.

7. Alpha Soli, I. Arceivala.1998. Wastewater treatment for pollution control - Second Ed. Tata McGraw Hill Publication Company Ltd., New Delhi.

8. Asthana, D.K. and Asthana, M.2001. Environmental Problems and Solutions. S. Chand and Co., New Delhi.

C. Abdul Hakeem College (Autonomous), Melvisharam.

Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15MZL203 Semester : II

Major - 6 Title: **Bio Technology**

Credits: 4 Max. Marks. 75

Objectives

To familiarize the use of the data and techniques of engineering and technology in biology for the study of living organisms, or derivatives of thereof, to make or modify products or processes for specific use. Also, to find solution of problems concerning human activities including agriculture, medical treatment, industry and environment.

UNIT-I: RECOMBINANT DNA TECHNOLOGY

Basic steps in Gene cloning - various types of restriction enzymes - ligase linkers and adaptors - c DNA - transformation - Selection of recombinants. Hybridization techniques chemical systhesis of oligonucleotides.
Gene probe - Molecular finger printing (DNA finger printing) - RFLP - the PCR techniques - Genomic library - Blotting techniques - Southern blotting - Northern blotting - Western blotting

UNIT-II: CLONING VECTORS

Plasmid biology - cloning vector based on E. coli PBR 322 and bacteriophage. Cloning vector for yeast. Cloning vector for Agro bacterium tumefaciens. Cloning vector for mammalin cells - Simian virus 40 - Gene transfer technology - Particle bombardment - Micro injection techniques.

UNIT-III: ANIMAL BIOTECHNOLOGY

Cell culture - Organ culture - whole embryo culture - Embryo transfer - In vitro fertilization (IVF) technology - Dolly - in vitro fertilization and embryo transfer in human. Transgenic animal. Human gene therapy. Cryobiology.

UNIT-IV: MICROBIAL BIOTECHNOLOGY

Fermentation - bioreactor - Microbial products - Primary & Secondary Metabolites - enzymes technology - single cell protein (SCP).Biopolymers, Biopesticides and Biofertilizers.

UNTI-V: ENVIONMENTAL BIOTECHNOLOGY AND APPLICATIONS OF BIOTECHNOLOGY

Bioremediation - bioremediation of hydrocarbons - Industrial wastes - Heavy metals - Xenobiotics - bioleaching - biomining - biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) - GM foods. Biotechnology & biosafety - IPR.

Reference Books

1. Purohit, S.S. and S.K.Mathur. 1999. Biotechnology Fundamentals and Application. Agro Botanica, New Delhi.

2. Alan Scragg. 1999. Environmental Biotechnoogy, Longman Publication.

3. R.C.Dubey 2001 A text book of biotechnology. Rajendra Ravindra Printer. New Delhi.

4. T.A. Brown 2004 Gene cloning and DNA analysis. Blackwell Science, Osney Mead, Oxford.

5. Dawson, M.T., Powell .R, and Gannon, F. 1996. Gene Technology. Bios Scientific Publishers.

6. Chopra, V.L. and Nanin, A.1992. Genetic Engineering and Biotechnology. Oxford and I BH Publishing Co., New Delhi.

7. Marx, J.L.1989 A Revolution in Biotechnology. Cambridge University, Press, Oxford.

8. Old, R.W.and Primrose, S.B.1985 Principlesof Gene Manipulations. An introduction to Genetic Engineering. Oxford Blackwell Publishers, London.

9. Winnacker, E.L. 2003. From Genes to Clones. Panima Publishing Corporation, New Delhi.

10. Gupta, P.K. 2004. Biotechnology and Genomics. Rastogi Publications, Meerut.

11. Das, H.K. 2004. Text Book of Biotechnology. Wiley Dreamtech India Pvt. Ltd., New Delhi.

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Syllabus for M.Sc., Zoology effective from the year 2015-2016

Year: I Year Subject Code : P15EZL201 Semester : II

Elective - 2 Title: **Biochemistry (Elective)**

Credits: 3 Max. Marks. 75

Objectives

To comprehend the chemical constituents of living matter, chemistry of food stuffs and their transformation in animal systems, the energy changes associated with these transformation and hormonal regulation.

UNIT-I: WATER

Water - Biological importance, pH and Acid - Base balance. Henderson Hasselbach equation. Buffers - Biological importance. Acidosis, Alkalosis. Electrolyte and water balance.

UNIT-II: BIOMOLECULES

Amino acids - structure, classification and function. Peptide bonds. Essential and non - essential amino acids, isoelectric point, switter ion. Protein - structure, classification, Properties of protein - Deamination, transamination, transmethylation.
Enzymes - general properties, function, classification, nomenclature. Enzyme kinetics - Factors affecting enzyme action, Mechanism of enzyme action, Enzyme regulation.

UNIT-III: BIOENERGETICS AND METABOLISM OF CARBOHYDRATE AND LIPIDS

Carbohydrate - structure, classification and biological significance.
METABOLISM
1. Glycogenesis, 2. Glycogenolysis, 3. Glyconeogenesis, 4. Glycolysis, 5. Embden Meyerhof pathway, 6. Hexose mono phosphate shunt. Lipids - structure and classification, Lipids of biological significance, Biosynthesis and Oxidation of Fatty Acids. Energetics.

UNIT-IV: HORMONES

General function, Classification - Steroid Hormones, Protein Hormones, Tissue Hormones.
Vasoactive Peptide Synthetic Hotmones. Mechanism of Hormone action.

UNIT-V: VITAMINS
Water and Lipid soluble Vitamins - structure, classification, sources and deficiencies in man. Metabolism of Xenobiotics - Detoxification and Biotransformation.

Reference Books

1. Murray, R. K, Granner, D.K. Maynes, P.A and Rodweli, V. W. 1998. Harper's Biochemistry. 25th Edition. McGraw Hill, New York.

2. Hames, B. D., Hoopa, N.M and Houghton, J.D. 1998. Instant notes in Biochemistry. Viva Books Pvt. Ltd. New Delhi.

3. Jain, J. L. Jain, S. and Jain N. 2005. Fundamental of Biochemistry, S. Chandra & Co. Ltd. New Delhi..

4. Vasudevan, D.M. and Sreekumar. S. 2000. Text of Biochemistry for Medicl students. Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi.

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year: II Year Subject Code : P15MZL301 Semester : III

Major - 7 Title: **Animal Physiology**

Credits: 4 Max. Marks. 75

Objectives

To derive an unified knowledge of the functions of animals, their parts, organs and their behaviour, through and understanding of their nutrition, respiration, circulation, excretion and physico-chemical coordination with a phylogenetic tinge.

UNIT I: NUTRITION

Nutrition - nutrients - digestion and adsorption of proteins, carbohydrates and lipids. Role of gastrointestinal hormones in digestion.

UNIT II: RESPIRATION AND CIRCULATION

Respiration in Invertebrates and Vertebrates - physiology of respiration in Man. Respiratory Pigments, nervous and chemical control of respiration, BMR.
Circulation - types of hearts - physiology of cardiac muscle - heart beat and its regulation - blood coagulation and theories.

UNIT III: EXCRETION AND OSMOREGULATION

Excretion – excretion of metabolic waste products in relation to the environment – physiology of excretion in Man. Iono – osmoregulation in Invertebrates (crustaceans), fishes, birds and terrestrial animals –hormonal control.

UNIT IV: COORDINATION

Neuro muscular co-ordination - types of neurons, transmissions of nerve impulse and reflex action. Molecular structure and chemical composition of muscle fiber and physiology of muscle contraction. Myoneural Junction. Endocrine glands in mammals - Hormones and Functions. Physiology of mammalian reproduction - reproductive cycle - hormonal control of reproduction.

UNIT V: BEHAVIOURAL PHYSIOLOGY

Bioluminescence - chemistry and functional significance. Behaviour (types - trophism, taxis, kinesis, reflex, learning). Temperature regulation in poikilotherms, homeotherms and heterotherms - hibernation, aestivation - diapause.

REFERENCE BOOKS

1. Hoar, W.S.1991. General and Comparative Physiology. Prentice Hall of India, NewDelhi.

2. Prosser, C.L. 1973. Comparative Animal Physiology,3rd edn. W.B. Saunders & Co., Philadelphia.

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year:	II Year	Subject Code :	P15MZL302	Semester :	III
Major - 8	Title:	**Developmental Biology**			
Credits:	4			Max. Marks. 75	

Objectives

To imbibe the current knowledge pertaining to the development of animal embryos of diverse taxonomic groups through analyses based on modern biological tools.

UNIT I: Early Embryonic Development

- The beginning of Organisms-Sperm and egg-Fertilization and its mechanism in Sea urchin and mammals
- Morphogenetic gradients and cell specification during animal development
- Fate map and early development in Sea urchin, tunicates, amphibians, fishes, birds and mammals

UNIT II: Organogenesis

- The stem cell concept and its origin
- Emergence of Central nervous system and epidermis-fate of neural crest cells-formation of eye
- Emergence of mesoderm-somites-urinogenital system-heart and blood vessels
- Emergence of endoderm-extra embryonic membranes
- Mammalian pattern of sex determination

UNIT III: Post Embryonic development

- Cellular and Nuclear differentiation-Nuclear transplantation experiments
- Metamorphosis-Amphibian metamorphosis-Insect metamorphosis
- Regeneration-Morphallactic regeneration in Hydra-compensatory regeneration in Mammalian liver
- Cell death and Ageing-genes involved and causes
- Germ cell determination and gamete maturation

UNIT IV: Cell communication in development

- Cell adhesion during development-role of cadherins and integrins
- Cell-cell signaling during development-mechanism and proteins involved
- Paracrine factors- induction and competence
- Signal transduction cascades during induction
- Role of extracellular matrix (ECM)

UNIT V: Medical aspects of Developmental biology

- Genetic errors of human development
- Embryological therapies (cancer as disease during embryonic development)
- Stem cell and tissue regeneration-Developmental plasticity and symbiosis

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year:	II Year	Subject Code :	P15MZL303	Semester :	III
Major - 9	Title:	**Immunology**			
Credits:	4			Max. Marks. 75	

Objective

To Understand the Structural and functional basis of immunoglobulins, the mechanism, mediators, detection and application of antigen-reaction in the immune system.

UNIT-I: IMMUNE BIOLOGY

The cellular constituents of the lympho reticular system-phagocytic cells, polymorpho nuclear neutophils, mono nuclear phagocytes, eosinophils and lymphocytes.

UNIT-II: IMMUNOGLOBULINS

Immunoglobulins-structure, isotypes and biological function. Antigenic determinant on immunoglobulin-isotype, allotype and idiotype. Immunoglobulin superfamily, monoclonal and polyconal antibodies. organization and expression of immunoglobulin genes. Synthesis of immunoglobulin and disorders of immunoglobulin synthesis.

UNIT-III: DETECTION AND APPLICATION OF ANITGEN ANTIBODY REACTION

Pracipitiation - agglutination - complement fixation - immunoassay using labelled reagents. Immunochromatography Test.

UNIT-IV: MECHANISM OF IMMUNE SYSTEM

Antigen-antibody interaction and immunodiagnostics. MHC- Restriction organization and inheritance of MHC, Antigen processing and presentation. T-cell receptors, B-cell Receptors, cytokine, adhesion molecules.

UNIT-V: CLINICAL IMMUNOLOGY

Immunity against viral, bacterial and parasitic infection –immunological basis of hypersensitivity – Graft rejection.

Vaccines: Types and use-prevention of post natal diseases –Tetanus, Diphtheria, Whooping cough, Cholera, Japanese Encephalitis, Measles and HIV infection.

REFERENCE BOOKS

1. Roitt,I.M.1994. Essential Immunology. Blackwell Scientific, Oxford.

2. Richard A.Goldsby, Thomas T.Kindt and Barbara A. Osborne. 2000. Kuby Immunology.Freeman and Co., New York.

3. Stites,D.P.,Terr,A.I. and Parsloio,T.G. 1997.Medical Immunology. Prentice Hall, New Jersey.

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7. Champion,M.D. and Cooke,A.1987.Advanced Immunology. J.B.Lippincott Ltd., Philadelphia.

8. Kannan,I.2007. Immunology. MJP Publishers, Chennai.

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year: II Year Subject Code : P15EZL301 Semester : III

Elective - 3 Title: **Biophysics (Elective)**

Credits: 3 Max. Marks. 75

Objectives
To imbibe the principles of physics involved in the structure of biomolecules, energy transformation in living systems and the modern physical instruments for the exploration of knowledge in biology

UNIT- I: STRUCTURE OF BIOMOLECULES

Electron configuration of an atom. Bonds - Covalent bond, Hydrogen bond. Forces between Molecules - Van der Waal's forces - hydrophobic and hydrophilic - biological importance.

UNIT- II: THERMODYNAMICS AND BIOLOGICAL OXIDATION

Laws of Thermodynamics - Concept of free energy and entropy - Exergonic and Endergonic reactions.
Diffusion - Fick's Laws, constant laws.
Oxidation and reduction reactions - Redox potentials in biological system, High energy phosphate group. Bioluminescence.

UNIT- III: MICROSCOPY
Electron microscope (SEM and TEM), Polarising microscope, Fluorescent microscope, Phase contrast microscope, Dark field microscope.

UNIT- IV: PHOTO BIOPHYSICS

Electromagnetic spectrum - visible and invisible region. Principles involved in Photoelectric colorimetry. Principle of Spectroscopy - UV & IR Spectroscopy in biological investigation. Effects of UV on biological systems.
Delayed effects of radiation - Ageing, reduction in life span, cancer.
Radioactive isotopes - measurements - GM tubes, Liquid Scintillation counters. Autoradiography. Effects of radiation.

UNIT- V: BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY

Biophysical aspects of vision, hearing, ECG and EEG.

REFERENCE BOOKS

1. Bose, S. 1982. Elementary Biophysics. Jyoth Books,

2. Bums, D.M. and MacDonald, S.G.G. 1979. Physics for Biology and Premedical students. ELBS and Addisson - Wesley Publishers Ltd., London.

3. Casey, E.J. 1962. Biophysics concepts and Mechanism. Affiliated East-West Press Pvt. Ltd., New Delhi.

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year: II Year Subject Code : P15MZL401 Semester : IV

Major - 10 Title: **Research Methodology**

Credits: 5 Max. Marks. 75

Objectives

The main objectives of this paper are to expose students to state of the art instrumentation, to introduce them to the principles and methods of various instruments used in biology and to prepare them to use these techniques in their own research. The course is a combination of lectures and demonstrations on basic principles and applications of the Spectrophotometers, Chromatographs and Electrophoresis system. With the aid of computer system and software, the students are also given hands on training in bioinformatics. Also, this paper is to acquire knowledge on the preparation of research manuscripts etc.

UNIT-I: AN INTRODUCTION TO RESEARCH METHODOLGY

Meaning and objective of Research
Types of Research (Basic, Applied, Inter-disciplinary and Trans-disciplinary)
Research Designs
Funding Agencies (UGC, CSIR, DST, DBT ICMR and ICAR).

UNIT-II: PREPARATION OF MANUSCRIPTS

Preparation of index cards- Reference collection - preparation of thesis - preparation of Scientific paper for publication in a Journal. Internet and e-journals. Computer aided techniques for data analysis, data presentation and slide preparation.

UNIT-III: BIOSTATISTICS & BIOINFORMATICS

Student‘t’ test, Skewness, Kurtosis, Chi – square (Computation required), Correlation square (Computation required), Regression square (Computation required) and ANOVA.
Internet - Worldwide Web - Search Engines - their functions. Boolean searching - file formats.
Biological data bases - searching source data bases - sequence similarity searches - FASTA and BLAST and Clustal-W.

UNIT-IV: SPECTROSCOPY

Absorption and Emission principles - Principle and application of UV-visible, Spectroflurometer, flame photometer, Atomic Absorption and emission spectrophotometers, NMR and Mass spectrometer in Biology.

UNIT-V: CHROMATOGRAPHY & ELECTROPHORESIS

Principles and Application of Chromatography: Paper, Thin layer, column, Ion Exchange, Gel filtration, Gas Liquid, HPLC and affinity.
Principles and Application of Electrophoresis: Paper, Agarose, PAGE, SDS PAGE and Iso-Electric focusing.

REFERENCE BOOKS

1. Anderson, Durston and Polle.1970. Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford.1979. Writing scientific papers in English. Pitman Medical Publishing Co., London.
3. Ewing, G.W. 1988. Instrumental methods of chemical analysis, McGraw Hill Book Company.
4. Daniel, M. 1989. Basic biophysics for biologists. Agro-Botanical Publishers, India.
5. Skoog, A., Douglas, J. and Leary, J.J. 1992. Principles of Instrumental Analysis. Sanders Golden Sunberst Series, Philadelphia.
6. Day, R.A. 1994. How to write and publish a scientific paper. Cambridge University Press, London.
7. Palanichamy, S. and M. Shanmugavelu.1997. Research methods in biological sciences. Palani Paramount Publications, Tamil Nadu, India.
8. Wilson and Walker. 2000. Practical biochemistry - principles and techniques. Cambridge University Press.
9. Milton, J.S. 1992. Statistical methods in Biological and Health Sciences. McGraw Hill Inc., New York.
10. Gupta, S.P. 1988. An easy approach to statistics. Chand & Co., New Delhi.
11. Gurumani, N. 2006. Research Methodology for Biological Sciences. MJP Publishers, Chennai.
12. Veerakumari, L. 2006. Bioinstrumentation. MJP Publishers, Chennai.
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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year:	II Year	Subject Code :	P15MZL402	Semester :	IV
Major - 11	Title:	**Evolution**			
Credits:	4			Max. Marks. 75	

Objectives

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

UNIT I: Historical Background and patterns of Evolution

- Importance of Evolutionary Biology and its application
- Evolution before Darwin and Evolution after Darwin
- Evolutionary synthesis
- Principles of evolutionary change based on systematics
- Evidences for evolution from taxonomy and fossils
- Trends and rates of evolution
- Theory of gradualism, Saltation and Punctuated equilibria

UNIT II: Evolutionary processes in Population and Species

- Variation and its sources
- Hardy-Weinberg principle and its significance
- Genetic variation in natural populations and its estimation
- Origin of Genetic variation-mutation-recombination-karyotype alterations
- External sources of variation-Hybridization, Horizontal gene transfer
- Genetic drifts and Neutral hypothesis

UNIT III: Natural Selection, Adaptation and Evolution above species level

- Natural Selection theory-experimental studies and methods of studying Natural selection
- Isolating mechanisms-barriers to gene flow-reproductive isolation-pre and post zygotic isolating mechanisms
- Species concept-modes of speciation (Allopatric, Parapatric, Sympatric, Polyploidy and Hybrid speciation)

UNIT IV: Evolution of behavior

- Behavior as phenotypic traits-variation within and among species
- The theory of foraging
- Evolutionary Stable Strategies (ESS)
- Sexual selection-concept-contests-paternity insurance-sperm competition-mate choice
- Social interaction and evolution of cooperation- theories of cooperation and altruism-inclusive fitness and reciprocation
- Interaction among related individuals-evidence for evolution by kin selection

UNIT IV: Patterns and Process of Behavior

- Micro-evolutionary changes in behavior
- Macro-evolutionary changes in behavior
- Behavior and Adaptive radiation
- Use of phylogeny in studying behavior-Cladistics and Phenetics
- Origin and evolution of sociality in insects, mammals and primates
- Human behavior and Sociobiology- selfish gene and behavior
- Advantages of social behavior

References

1. Agarwal, V.K., 2012. Animal Behavior (Ethology). S. Chand and Co, New Delhi

2. Futuyma, D.J., 1998. Evolutionary Biology. Sinauer Associates, USA.

3. P.A.Moody. 1978. Introduction to Evolution. Harper International.

4. G.L. Stebbine. 1979. Process of Organic Evolution. Prentice Hall India, New Delhi.

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year: II Year Subject Code : P15MZL403 Semester : IV

Major - 12 Title: **Entomology**

Credits: 5 Max. Marks. 75

Objectives

To catch up with the tremendous strides of expansion of knowledge in Entomology, this paper is meant to comprehend the classification of insects, economic importance of Entomology with special reference to beneficial insects, sericulture, insect pests and their control, vector borne diseases etc.

UNIT- I : CLASSIFICATION

Classification of insects up to order level.

UNIT- II: PHYSIOLOGY OF INSECTS

Physiology of Flight Muscle, Insect respiration, Structure of Secretory glands, Pheromones, Moulting Hormones

UNIT- III: BENEFICIAL INSECTS

Apiculture

Species of Honey bees, Chemical composition of Honey, Biology of Honey bees and their management, By-products. Lac insects and their management.

UNIT- IV: INSECT PESTS AND THEIR CONTROL

Insects as crop pests

(Paddy: Rice earhead bud bug-*Leptocorisa acuta*, Rice stem borer- *Scripophaga incertulas*

Sugarcane: Leaf hopper – *Pyrilla perpusilla*, Shoot borer – *Chilo infuscatellus*

Groundnut: Red hairy caterpillar – *Amascta albistriga*, Pod bug - *Elasmolomus sordidus*

Cotton: Cotton aphid – *Aphis gossypii*, Bollworms – *Platyedra gossypiella* and *Helicoverpa armigera*)

Types of injuries and loss caused to plants in general. Factors governing the outbreak of pests.

Principles and methods of pest suppression: Conventional and Non- conventional, Biological and Integrated pest management.

UNIT- V: INSECTS AS VECTORS

Vector borne diseases (Protozoan – Malaria and Filariasis; Viral - Dengue, Chiekenguniya and Zika).

Method of transmission of parasitic agents.

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REFERENCES BOOKS

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19. Sundari, M.S.N. and Santhi, R. 2006. Entomology. MJP Publishers, Chennai

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Syllabus for M.Sc., Zoology effective from the year 2016-2017

Year:	II Year	Subject Code :	P15EZL401	Semester :	IV
Elective - 4	Title:	**Sericulture (Elective)**			
Credits:	3			Max. Marks. 75	

(This Paper is compulsory for those not choosing Project / Dissertation with Viva voce)

Objectives

To infuse sound knowledge about the silkworm, their economic importance and diseases and to disseminate Sericulture as a need - based curriculum.

UNIT -I: ECONOMIC IMPORTANCE AND SILKWORM BIOLOGY

Prospects and status - Trends of production and its economic importance - demand and utilization. Silk producing species - their distribution - Bombyx mori - life cycle - organization of larvae, pupae and moth - structure of the silk gland.

UNIT-II: MORICULTURE

Mulberry - varieties - distribution - methods of cultivation and preparation - Harvest - Transport and preservation of leaves. Feeding and nutrition - specificity of diet - Factors of nutrition - Diet and growth. Pest and diseases.

UNIT-III: SILKWORM REPRODUCTION AND GENETICS

Reproduction - Growth and Development of silkworms - Physiology of molting in different varieties (Uni, bi and multivoltine) - Endocrinology of reproduction and development. Genetics - mutation breeding and development of new strains.

UNIT-IV: PATHOGENIC DISEASES AND PEST

Pathology - Viral, bacterial, fungi and protozoan diseases - control mechanisms. Uzifly menace.

UNIT-V: SILKWORM REARING AND SILK REELING

Rearing operations - Selection and construction of rearing house - Incubation - Hatching - brooding, Harvesting etc. Reeling techniques - lacing - skinning. Re-reeling etc,

REFERENCE BOOKS:

1. Ganga, G. and Sulochana Chetty, J. 1997.An Introduction to Sericulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Ganga, G. 2003. Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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6. Eikichi Hiratsuka. 1999. Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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8. Soo-Ho Lim, Young-Taek Kim, Sang-Poong Lee. 1990. Sericulture Training Manual - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

9. Wu Pang-Chuan and Chen Da-Chuang. 1994. Silkworm Rearing - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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